Heating Piping & Air Conditioning

NOVEMBER 1961

. . . for Consulting Engineers
Mechanical (HPAC) Contractors
Engineers with Plants & Buildings

Flexible Connectors Aid Piping Designs . . . page 120

•

Success Story: Heat Pump's Five Year Operating Record . . . page 115

•

Conditioned, Pressurized Air Supports Flexible Radome . . . page 126

•

Performance Curves and Centrifugal Pump Selection . . . page 130

•

Plant Ventilation Can Be More Effective, Cost Less . . . page 141

•

Good-Better-Best Ways To Control Fan-Coil Units . . . page 146

•

ENGINEERING DATA FILE Equipment Corrosion — Its Nature and Control . . . page 161

Contents . . . page 5

Again and again, JENKINS VALVES are the bankers' choice

Newest, Most Dramatic Example is the World-headquarters of

THE CHASE MANHATTAN BANK

Architect: Skidmore, Owings & Merrill; General Contractor: Turner Construction Co.; Consulting Engineer: Jaros Baum & Bolles; Heating & Air Conditioning Contractor: Raisler Corp.-Kerby Saunders, Inc., all of New York

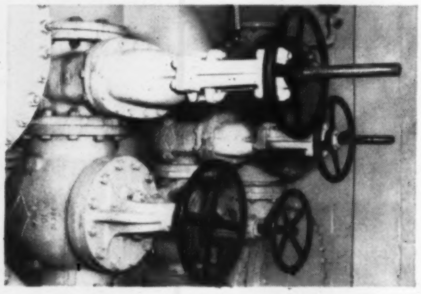
Biggest commercial office building in 25 years . . .
biggest self-contained banking edifice in the world . . .
60 stories high . . . 2,250,000 square feet . . .

You could fill this magazine with superlatives about The Chase Manhattan's architectural triumph now standing proudly in the Free World's financial heartland on lower Manhattan Island.

But you'd miss one essential superlative if you failed to mention the thousands upon thousands of Jenkins Valves installed throughout the heating and air conditioning systems — even for snow-melting!

For a bank, or for you, there's no sounder investment than Jenkins Valves. Good for a building-lifetime of service, paying day-to-day dividends in savings on maintenance.

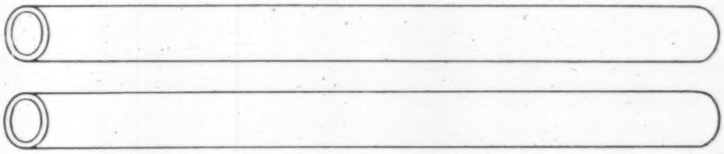
Known everywhere as the "standard of quality," Jenkins Valves *cost no more*. That simple fact appeals to bankers, their architects, engineers and contractors. And *you* — did you realize that you can specify Jenkins without paying a penny more than you'd pay for any lesser brand name on good valves? Jenkins Bros., 100 Park Avenue, New York 17, New York.



JENKINS
MOST TRUSTED TRADEMARK IN THE VALVE WORLD
VALVES
JENKINS SINCE 1864
Jenkins Bros

AVAILABLE FROM LEADING DISTRIBUTORS EVERYWHERE

What's so different about stainless tubing?



What's so different about stainless tubing? Take two stainless tubes made by different manufacturers to the same specification. Put them in a heat exchanger. In service, they may react differently.

One tube successfully resists corrosion, the other doesn't. One holds up under pressure at operating temperature, the other fails. Why?

Basically, the difference in stainless tubing starts with who makes it.

One manufacturer maintains quality controls from melting of steel to finished tube. Another may not. One tube maker will carefully match stainless grades and properties to be sure the tube is *Job-Matched* to the user's specific requirements. Another won't. The differences go on and on.

The surest way to know how the differences in stainless tubing will benefit you is to know the manufacturer and what he can do. Then, specify his product by name when you order direct or through your Steel Service Center. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

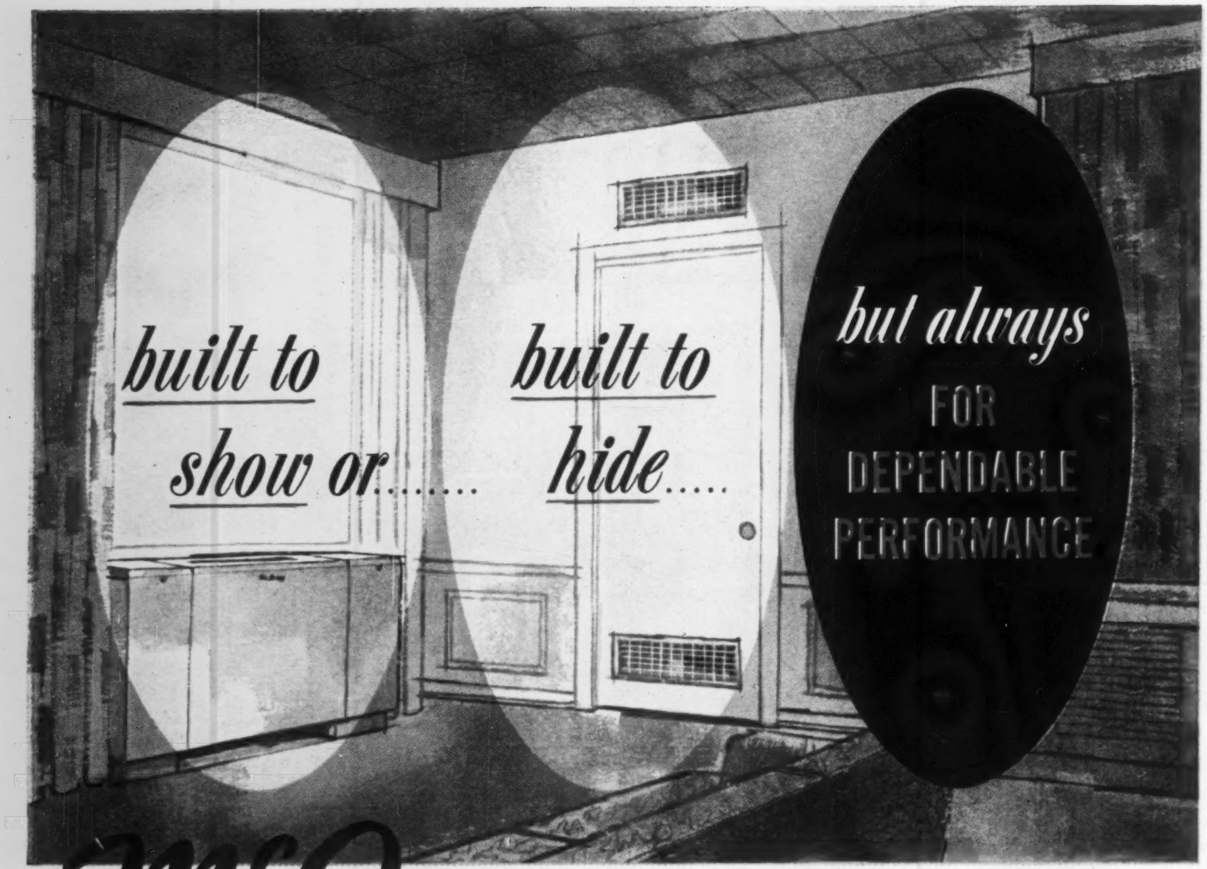
B&W

THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION

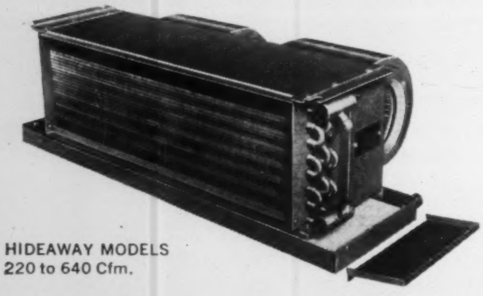
TA-1039S

Seamless and welded tubular products, solid extrusions, rolled rings, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals


built to show or.......
built to hide.....
but always FOR DEPENDABLE PERFORMANCE

McQuay

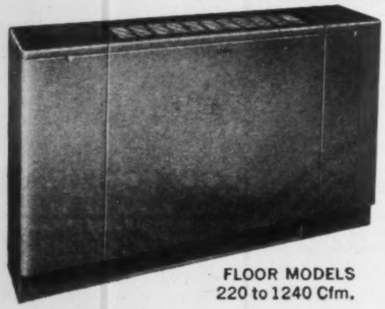
individual room **SEASONMAKERS**



HIDEAWAY MODELS
220 to 640 Cfm.

Your design plans may specify a free standing floor conditioner, or possibly floor units semi or fully recessed, and in some instances, closet or false ceiling installations or horizontal ceiling units mounted in the conditioned space—but, regardless of what your plans require, there is a McQuay Seasonmaker designed to meet your specifications. Four individual models, floor, basic, ceiling and hideaway styles in 24 sizes, with a complete accessory line for each style, offer you the versatility and flexibility required in modern design.

Before you specify or install, insist on comparing the McQuay Seasonmaker with all others for quality construction, quietness, appearance and performance. Your McQuay representative will give you complete Seasonmaker information, or write to McQuay, Inc., 1601 Broadway N.E., Minneapolis 13, Minnesota.



FLOOR MODELS
220 to 1240 Cfm.

McQuay INC.
AIR CONDITIONING • HEATING • REFRIGERATION

MAKE THE SEASONS COME TO YOU

Heating, Piping & Air Conditioning

FOR CONSULTING ENGINEERS, MECHANICAL (HPAC) CONTRACTORS, ENGINEERS WITH PLANTS AND BUILDINGS

VOL. 33, NO. 11 NOVEMBER 1961

FEATURES

Heat Pump System Has Excellent "Satisfaction Record" After 5 Years Shopping Center Operation 115

Flexible Connectors, Properly Used, Can Ease the Strain of Piping Design, Installation 120

Air Conditioning, Pressurization System Supports Flexible Radome, Improves Radar Transmission 126

A Better Understanding of Performance Curves Can Assist You in Selecting Centrifugal Pumps 130

How Coordinated Air Conditioning Design Solves Many Environmental Problems in Research Lab 136

Joint Industry Committee Presents the *New* Chicago Plan for Separate Bids 139

Industrial Ventilation Can Be More Effective and Cost Less 141

The Many Ways of Controlling Fan-Coil Units — Engineers Can Match Systems with Requirements 146

When and Why Gas Engines Should Be Considered As Air Conditioning Prime Movers 152

Sectional Committee Interprets Code for Nuclear Piping 157

DATA SHEET

Tables of Sheet Metal Duct Weights for Various Sizes, Materials, Gages 159

HPAC ENGINEERING DATA FILE

Equipment Corrosion: How It Occurs; How to Control It 161

DEPARTMENTS

Letter from the Editor 11

You'll Want to Know 43

"Open for Discussion" 101

Question of the Month 110

Equipment Developments 183

Recent Trade Literature 228

We Hear That 254

Meetings and Conventions 258

New Books and Reports 262

Index to Advertisers 268

Board of Consulting and Contributing Editors . . . . LESTER T. AVERY, N. R. BERNZ, JOHN E. BROCK, LEO F. COLLINS, SABIN CROCKER, CARL A. DOPP, PHILIP DRINKER, M. K. FAHNESTOCK, WILLIAM GOODMAN, WILLIAM A. HANLEY, E. P. HECKEL, R. E. HIERONYMUS, JOHN A. HOLBROOK, LEE P. HYNES, C. W. KIMBALL, A. C. KIRKWOOD, SAMUEL R. LEWIS, H. C. MURPHY, LESTER S. RIES, K. E. ROBINSON, F. B. ROWLEY, ROBERT P. SCHOENIJAHN, T. S. TENNEY, RUSH D. TOUTON, EPH A. TYLER.

Editor .... ROBERT W. ROOSE
Engineering Editor . DONALD R. BAHNFLETH
Associate Editor .... JAMES D. WILDER
Associate Editor .... ARTHUR R. GOLLBERG
Editorial Assistant .... MARY E. HOLLIGAN

Advertising Staff . . . . WALLACE J. OSBORN, ROBERT J. OSBORN, and RICHARD G. OSBORN, New York—Yukon 6-1450 .... ROBERT A. JACK, Cleveland—Superior 1-1291 EDWARD J. LYNCH, Detroit — Trinity 2-6424 JOHN L. LEWIS, Pittsburgh — Locust 3-1130 . . . . GEORGE C. CUTLER and THOMAS V. JOHNSON, Chicago—State 2-6916 . . . . JAMES D. THOMAS, Tucson—East 6-3698 . . . . WETTSTEIN, NOWELL & JOHNSON, INC., Los Angeles—Dunkirk 8-2286, Portland —Capitol 8-4107, San Francisco—Yukon 2-9537.

President .... CHAS. E. PRICE
Exec. Vice Pres.
& General Mgr. .... C. M. BURNAM, JR.
Subscription Sales Mgr. .... WM. STRONG
Production Mgr. .... LAWRENCE A. DOYLE

Merged with Heating, Piping & Air
Conditioning is the Aerologist

Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $5.00 per year; Canada, Cuba, Mexico, Central America, South America, Spain, $7.00 per year; other, $10.00. Current copies, $1.00 each; back copies, $1.25 each. Member Audit Bureau of Circulations and Associated Business Publications, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc., and Industrial Arts Index and is microfilmed by University Microfilms. ©1961 by the Keeney Publishing Co., SECOND-CLASS POSTAGE PAID AT CHICAGO AND MENDOTA, ILL.

SUBSCRIBERS—*Change of Address*: Publisher needs five weeks' advance notice, mail address from current issue envelope, and new address with city postal zone number. Mail to . . . Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill., U.S.A. POSTMASTER: *When Magazine Is Undeliverable*: Send Form 3579 to Publisher at above address. Include city postal zone AND DATE *on last line* under mail address on envelope as our *key*.

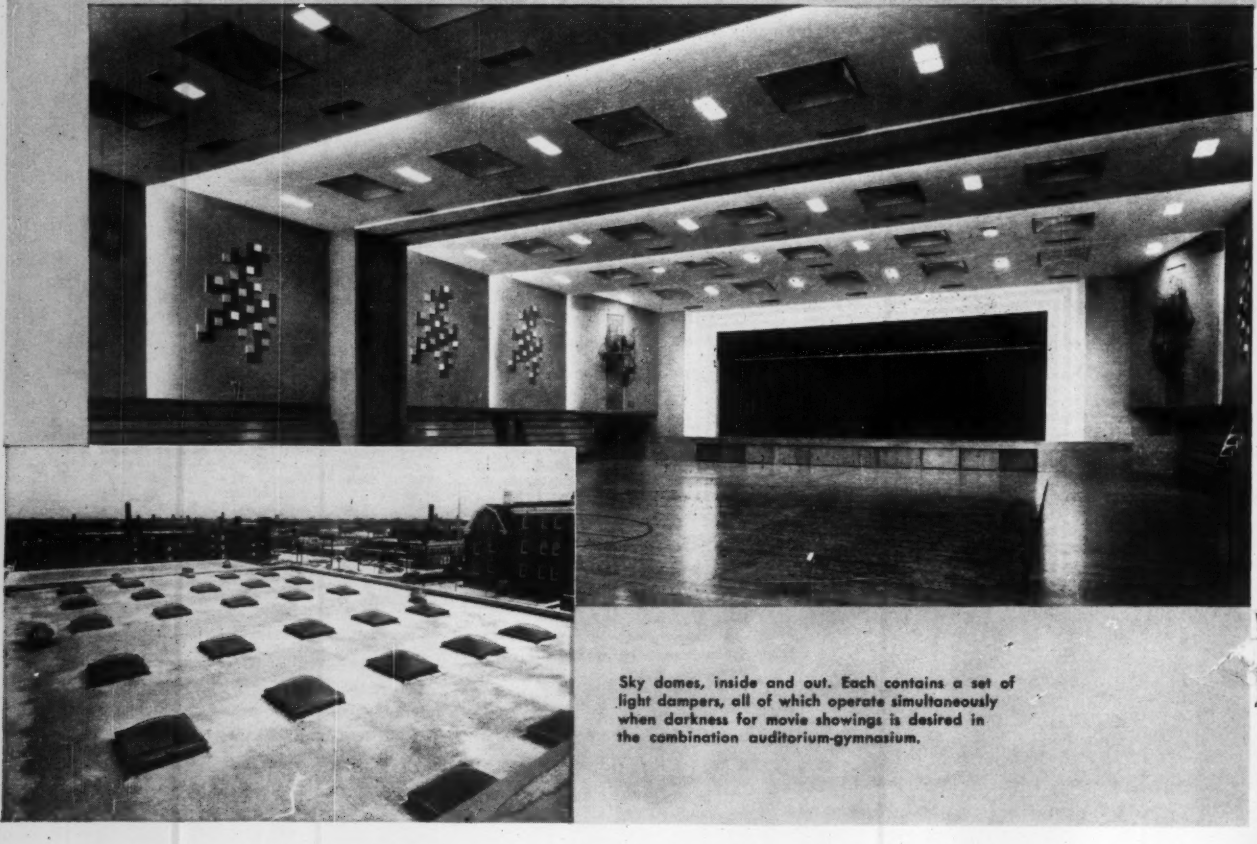
Imaginative Engineering Puts to Work on *DAYLIGHT*

Mike Best and Ed Kralovec, mechanical engineers on the Madonna school, shown discussing job details with two of their colleagues.

Kralovec & Best, consulting engineers, went one step further in their heat and ventilation design for the new Madonna High School, Chicago — they applied pneumatic control to skylight louvers.

To meet the lighting requirements of the combination auditorium-gymnasium, architect C. I. Krajewski used a system of sky domes equipped with adjustable light dampers. How to control the dampers quickly and efficiently for change-over from plenty of daylight for gym activities to total blackout for movies, etc., was the problem presented to the consulting engineer.

Kralovec & Best's solution was — twenty-nine 4-inch powerstroke piston damper motors — one for each of



Sky domes, inside and out. Each contains a set of light dampers, all of which operate simultaneously when darkness for movie showings is desired in the combination auditorium-gymnasium.

Powers Pneumatic Control

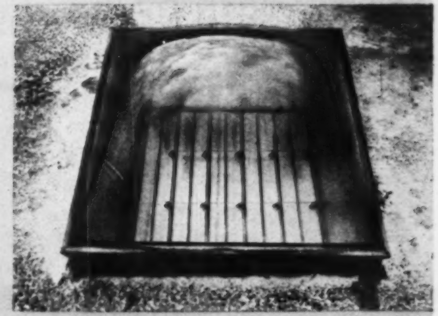
MADONNA HIGH SCHOOL
Chicago, Ill.
Architect: C. I. Krajewski, Chicago
Consulting Engineers:
Kralovec & Best
Chicago
Heating Contractor:
Windsor Heating Co.
Chicago

the sky dome louvers on the roof — energized instantly from a single Powers pneumatic selector switch in the projection room. Turning the switch activates air pressure at 15 psi. through a Powers Series 500 Pilot Valve to the motors to close the light louvers. When the switch is turned off, pressure is released . . . and the louvers swing open to admit light.

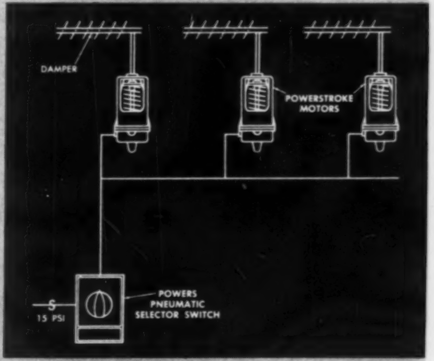
Pneumatic control of daylight in Madonna school is fast, easy and quiet — a definite convenience for the projectionist or instructors, an operational bargain for the school, maintenance-wise.

The complete heating system, as specified by Kralovec & Best, includes two hot water converters controlled at fixed temperatures. Individual classrooms are heated and ventilated by unit ventilators, controlled on the standard day-night cycle. Corridors, rest rooms, storage and locker rooms employ direct radiation controlled by Powers Day-Night room thermostats. For extra safety and comfort, hot water to all showers is controlled by means of a Powers Hydroguard Thermostatic Shower Control.

Here, then, is how imaginative engineering applied to pneumatic control can have unusual — but practical — results in an efficient, low cost system.



A single pneumatic selector switch in the projection room actuates 29 sets of light louvers through 29 individual powerstroke motors.



Write for the latest Powers Catalog of pneumatic controls for schools.

THE POWERS REGULATOR COMPANY
DEPT. 1161 — SKOKIE 6, ILLINOIS | *Offices in Principal Cities in U.S.A. and Canada*
CONTROL SYSTEMS SINCE 1891

WAGNER®
MOTORS
AT
WORK

power to cool a clerical center

Two Wagner® 900 hp motors utilize easily accessible low voltage power to drive centrifugal compressors in New York's Interchurch Center

One of the newest office buildings in the city, the 19-story Interchurch Center houses more than 2,000 workers. It is completely air conditioned . . . all 400,000 square feet of it.

It's a big job, powering the centrifugal compressors in a system that is designed to air condition that much space. A job usually handled by high voltage motors, but done here by two 900 hp Wagner® Type RP open type motors rated at 460 volts, 1750 RPM. They were specified to take advantage of an easily accessible low voltage power supply, and so eliminate the expense of running in a high voltage line. How do they perform under loads created by centrifugal compressors? Simply put, they operate at peak efficiency, day in and day out.

Compact and dripproof, Wagner RP motors are packed with power and stamina. They're the perfect drives for big pumps, fans, and blowers as well as compressors. Built in frame sizes 504U through 962S, Wagner open type motors are available in ratings through 1000 horsepower.

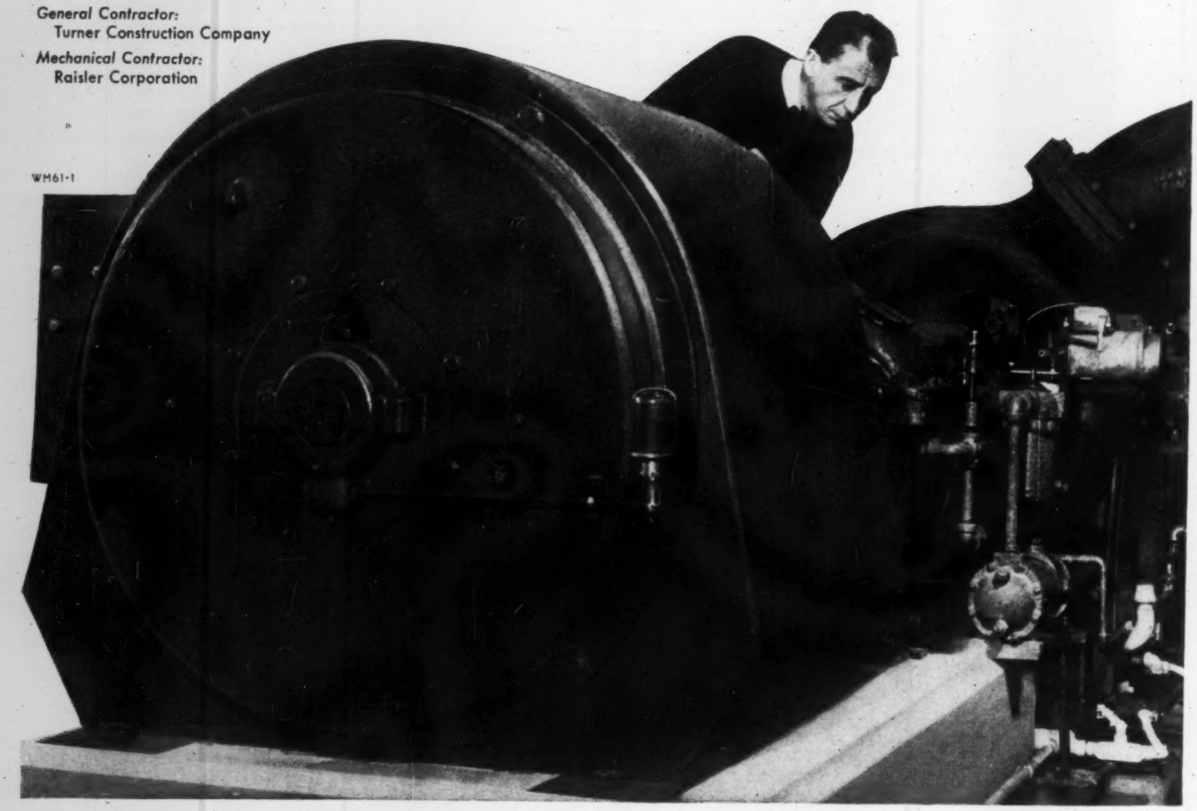
Want your motor application analyzed? Call your Wagner Sales Engineer. His recommendations, and Wagner motors, will serve you well.

Branches and Distributors in all Principal Cities

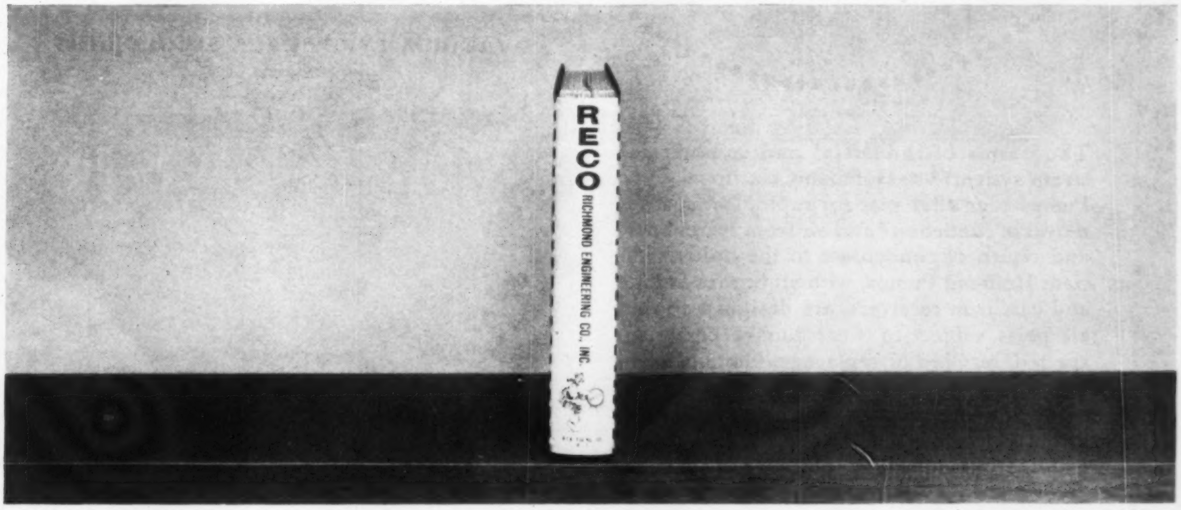
Wagner Electric Corporation
6370 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

THE INTERCHURCH CENTER
Owner: The Interchurch Center
Architects:
Collens, Willis and Beckonert
Vorhees Walker Smith Smith & Haines
General Contractor:
Turner Construction Company
Mechanical Contractor:
Raisler Corporation

WM61-1

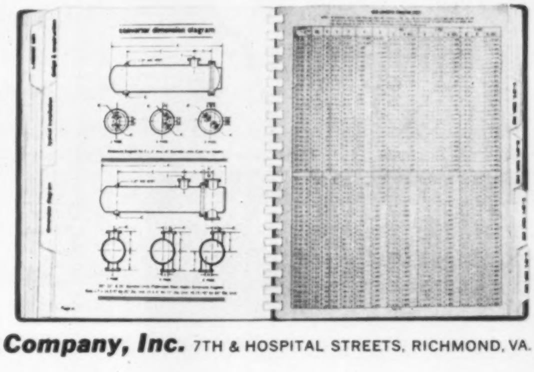


Clear the shelf . . .


RECO RICHMOND ENGINEERING CO., INC.

for your single source of sizing data! This comprehensive new reference volume gives you all the data you need for quick, accurate sizing of instantaneous heaters, convertors and other shell and tube heating units. Over 500 pages—all clearly indexed and tabbed for instant reference! You can quickly turn to descriptive product data, typical installation diagrams, dimension diagrams, and reference charts of dimensions and calculations. This helpful specifying data is in accordance with the ASME Code and standards of the Fuel Oil and Water Heater Manufacturers Assoc. Write—or ask your nearby RECO representative.

HEAT EXCHANGER EQUIPMENT
RECO
RICHMOND ENGINEERING COMPANY, INC.
RICHMOND GREENSBORO COLUMBIA


convertor dimension diagram

Richmond Engineering Company, Inc. 7TH & HOSPITAL STREETS, RICHMOND, VA.

HOFFMAN

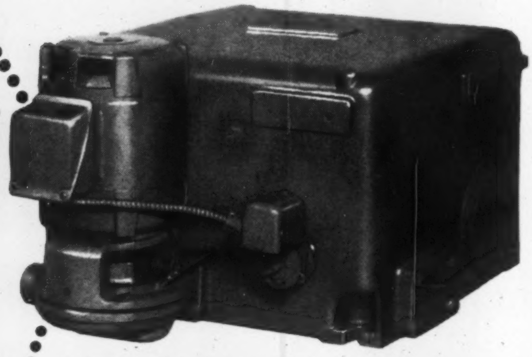
CENTRIFUGAL-TYPE

PUMPS

Unequalled Quality

Your Best Buy

CONDENSATION TYPE "HCS" SINGLE UNIT

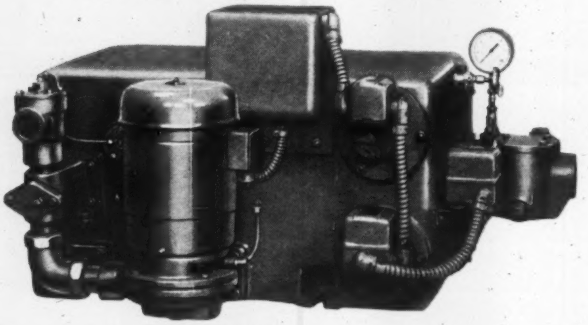


Single and Duplex Units

Capacities through 150,000 sq. ft. E.D.R.

Featuring compact, Centrifugal Pump Design

VACUUM TYPE "HVS" SINGLE UNIT



Single and Duplex Units

Capacities through 100,000 sq. ft. E.D.R.

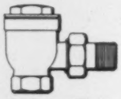
Featuring Hoffman Jet Vacuum Producer

Thousands of industrial and commercial steam systems use Hoffman Centrifugal Type Pumps year after year for rapid, low-cost removal of condensate and air from steam lines, and return of condensate to the boiler. Efficient Hoffman Pumps, with all bronze fittings and cast iron receivers, are designed so that all parts subject to wear can be easily inspected, serviced or replaced without disturbing piping. For small systems, Hoffman's line of quality-engineered "Watchman" Condensation Pumps have ratings up to 12,000 sq. ft. E.D.R. Hoffman sales-engineers are available at all times for consultation.

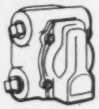
HOFFMAN COMPLETE LINE OF SPECIALTIES...STEAM AND WATER

Radiator Vents

Main Vents



Radiator Traps

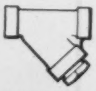


F&T Traps

Union Ells

Bucket Traps

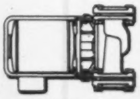
Pressure Reducing Valves



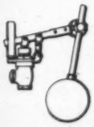
Strainers

Temperature Regulators

Vacuum Breakers



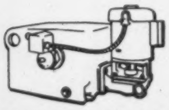
Hot Water Circulators



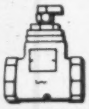
Float Valves

HOFFMAN SPECIALTY MFG. CORP.
1700 W. 10TH STREET
INDIANAPOLIS 7, INDIANA

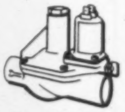
VALVES • TRAPS • PUMPS • STRAINERS • REGULATORS



Condensation Pumps



Flow Control Valves



Zonal Valves

LETTER FROM THE EDITOR

November 1961

Dear Reader:

Realizing the value of following up on an earlier report of an installation, we have done so at the Southdale Shopping Center heat pump job in Minneapolis. The report of what has been happening since the system was installed about five years ago and how well satisfied the engineers and tenants are is given on page 115. How has it been working? What changes have been necessary? These and other questions are answered in this article which also includes some interesting operating data for summer and winter peak load periods.

As you know, the use of flexible metal hose in piping systems can aid greatly in solving problems of pipeline motion, vibration, and misalignment. The article on page 120 includes a basic discussion of what should be considered when planning to use these devices and how they should be installed. Tables are also included along with a list of Do's and Don'ts which should serve as a guide and good reference for you.

The problems of maintaining a controlled, pressurized environment in a flexible spherical radome are presented by Philip Green in his article on page 126. These radomes enhance radar transmission efficiency and cause less beam distortion than do rigid enclosures, but suffer more from high wind loads. Exact interior pressurization with ultra-clean and conditioned air is necessary to resist wind loads -- but not enough to expand or distort the fabric. Mr. Green explains how this has been done.

To aid in your better understanding of centrifugal pump operation and application, Harold Woodhouse has prepared the article on this subject which begins on page 130. He explains the importance of knowing what the performance curves mean and how they can be used in selecting and using the proper pump for each particular job. Following his suggestions, the number of disappointing installations will surely be decreased.

Real progress is being made in Chicago in achieving agreement among architects, engineers, and builders to support the plan for separate bids and specifications for general construction and each of four specialties, including heating, piping, and air conditioning, and ventilation. Henry J. Couch, executive secretary of the Coordinating Committee of the Mechanical Specialty Contractors Associations of Chicago explains on page 139 what has been done since this new bidding plan was suggested one year ago. He suggests that you write to him for a copy of the new brochure which presents the plans and means for implementation.

LETTER FROM THE EDITOR (Continued) --

The growing importance of improving the industrial environment in the large plants of today is certainly evident. Of course part of the problem has been increased by the development of high speed, heat producing processes together with the use of flat roof buildings. The article on page 141 presents data obtained in various parts of the country which indicates that it is possible to provide comfortable working conditions in modern plants for reasonable cost if the problem is approached properly. I believe you will be interested in this report. Some of the findings are not what you might expect.

Controlling fan-coil unit air conditioning systems can be done in many different ways, and John Pratt explains what these various methods are in his article on page 146. Mr. Pratt presents a basic discussion of what can be achieved and how it can be done. He includes four recommended methods for your consideration.

Since natural gas has been becoming more available throughout the country recently, the use of natural gas engines as prime movers for air conditioning has been increasing. Of course with this as with all engineering decisions, the economics involved play a vital role in the analysis. The kind of study that should be made is outlined by Jack Gill on page 152. Not only are the cost factors important, but such items as noise, expected maintenance, the type of operation being planned, space available for equipment, plus several others should all be weighed carefully.

Recent pipe code case interpretations for nuclear piping systems are presented on page 157.

More tables for calculating weights of sheet metal ducts are given in the Data Sheet on page 159. This is the second set of tables prepared for you by Willie Hammer. The Data Sheet in the October issue had the first ones.

With corrosion costs soaring each year, we felt you would undoubtedly appreciate having an Engineering Data File prepared for your reference on the subject of corrosion and how to control it. It begins on page 161, and as with the others, this Engineering Data File represents many hours and days of interviewing, reporting, checking, and writing on the part of Don Bahnfleth, HPAC Engineering Editor, to put this together for you. He stresses the importance of thoroughly understanding the various types of corrosion in order to properly control it. Then with these fundamentals known, the methods for controlling corrosion can be put into effect which will produce the desired result. This should provide a good reference for you.

Two answers to the Question of the Month are given on pages 110 and 112 which you will find interesting, I hope. Comments from several readers are in the Open for Discussion pages on 101 through 108. Eight pages of news, notes, and other short items are on pages 43 through 50 in the You'll Want to Know section.

Bob Roose
Editor

PROTECTED
AGAINST
FIRE
BY
IMPERIAL
DAMPERS

THE ONLY FIRE DAMPER PRODUCED UNDER THE FACTORY INSPECTION & LABEL SERVICE PROGRAM OF THE UNDERWRITERS' LABORATORIES INC.

FIRE UL DAMPER
RATING
1-1/2 HOURS
Imperial
DAMPER CO.
NEW YORK N.Y.

Public Service Company of Colorado
New Headquarters Building in Denver

Architect: Berne, Muchow, Baume & Pollvnick
General Contractor: Mead & Mount Const. Co.
Consulting Engineer: Clint Cator Company
Mechanical Contractor: Natkin and Company
Sheet Metal Contractor: Sam Fox Sheet Metal Co.

Reduce insurance costs with an approved damper. Imperial Damper No. VWNYT-1 bears the Underwriters' Laboratories Label—first and only damper to do so!—and also has been approved by the N.Y.C. Board of Standards and Appeals for use in the city: It is the first and only damper to gain the BSA approval and label! Be safe and sure with Imperial Dampers... trap fire *before* it spreads.

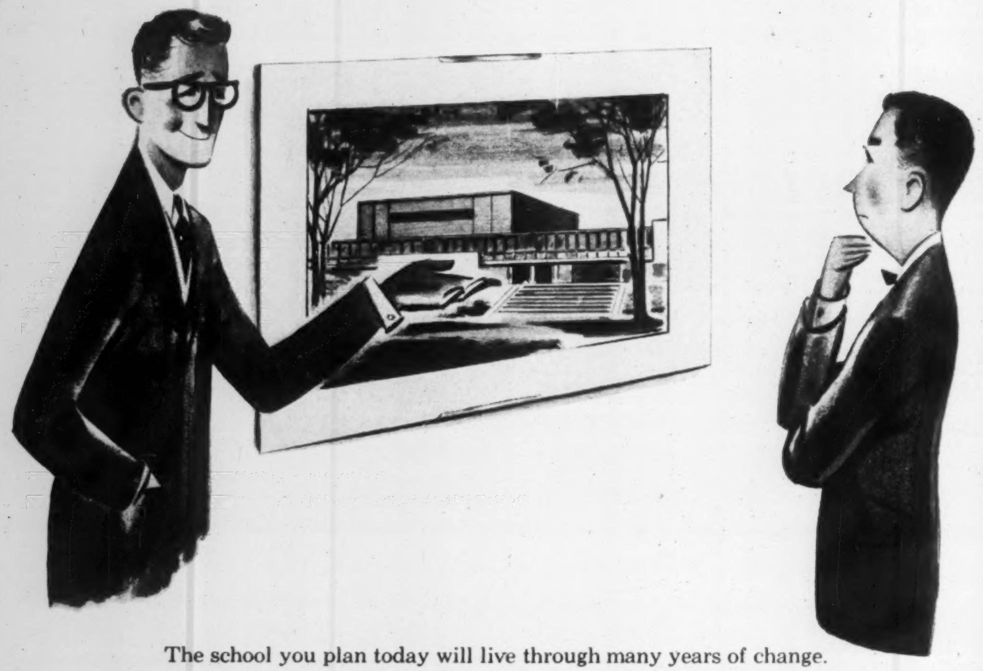
FEATURES	U.L. 1½ HOUR TESTS	U.L. FACTORY INSPECTIONS	APPROVAL BY N.Y.C. BOARD OF STANDARDS AND APPEALS
Competitor X	NO	NO	NO
Competitor Y	NO	NO	NO
Competitor Z	NO	NO	NO
IMPERIAL MODEL VWNYT-1	YES	YES	YES

IMPERIAL
DAMPER COMPANY
664 EDGECOMBE AVENUE, NEW YORK 32, N. Y. • PHONE LO 8-9100

Send for information on our Mixing Dampers, Backdraft Dampers, Shutters, Stationary and Adjustable Formed and Extruded Louvers.

Will your school design stand the test of time?

Changing educational patterns demand flexible schools with learning spaces equipped for year-round air conditioning under unitary control— as an economic necessity based upon educational productivity for the life of the building.

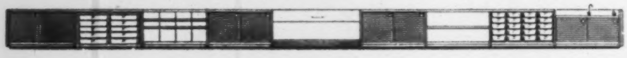


The school you plan today will live through many years of change.
How well will it *serve* in these dramatic days ahead?
Education is already in revolution. Some of the demands for flexibility
in schoolhouse design and facilities can be seen and dealt with now.
What requirements may yet be imposed by the swift march of progress
cannot, unfortunately, be wholly anticipated. But this much is sure:
Maximum learning depends upon a controlled thermal environment in every space.
And with the definite trend toward the greater use of a school's facilities,
it is little short of planned obsolescence to build a school today
without means for air conditioning as well as heating and ventilating.
You can be sure your building will provide this year-round comfort with economy
by giving thoughtful consideration to it in the designing stage.
Nesbitt—with long experience in the school field—offers a slide film presentation,
case studies, cost data, and many other services to help you and your clients
appraise the importance of air conditioning for your next school.

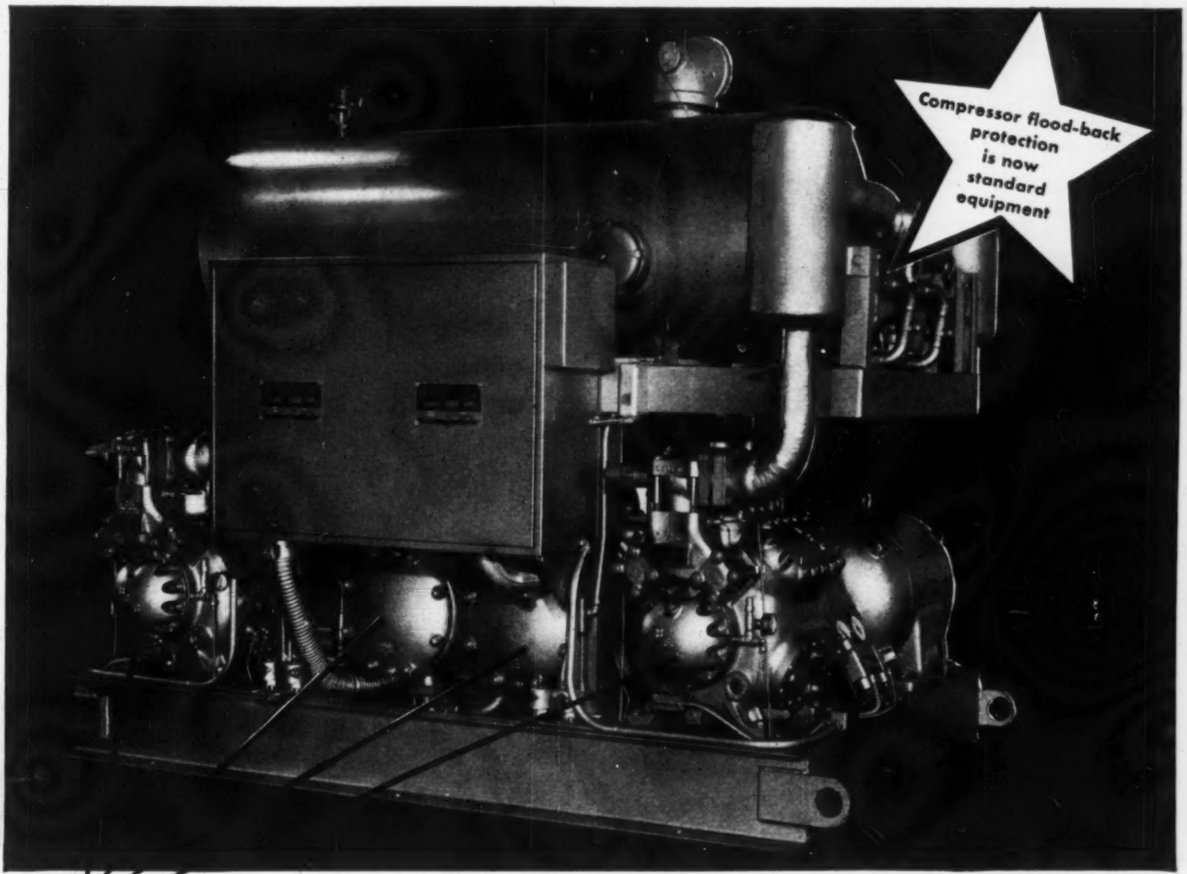
MORE LEARNING PER SCHOOL DOLLAR

Nesbitt AIR CONDITIONING FOR SCHOOLS

BASIC INGREDIENT
Excellence
Nesbitt
Heating Ventilating Air Conditioning



Year-Round Unit Ventilator and Storage Cabinets • Made and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa.



2 COMPLETE CIRCUITS WITH AUTOMATIC LEAD-LAG

The B&G Package Liquid Cooler is now available *with two complete refrigeration circuits*...dual compressors, dual condensers and a single evaporator! It has a capacity reduction of 25%—in stages of 100, 75, 50 and 25%. All operative and safety controls are installed and pre-wired.

An outstanding feature is the automatic lead-lag selector switch. In operation, No. 1 motor and compressor handle the load until cooling requirements are satisfied or until No. 2 unit needs to be called into use. On the next starting, No. 2 unit picks up the load. *Therefore each motor and compressor gets equal usage!* This dual arrangement is also valuable because it provides stand-by protection in case of emergencies.

Remember, too, that all major parts of B&G "package" units are manufactured and guaranteed by Bell & Gossett Company...*one* responsibility for satisfactory operation.

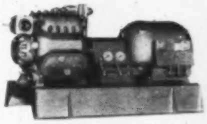
Send for complete engineering data on B&G Air Conditioning and Refrigeration equipment.

M-PAK
MODULAR PACKAGES

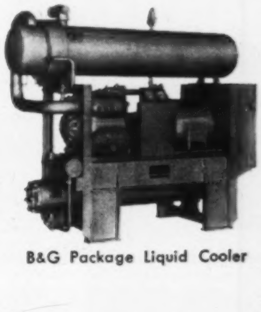
M-Pak units make it possible to build up from factory stock a comprehensive line of motor compressors, condensing units and package liquid coolers. Starting with five basic compressors, other stocked components are added to make up the unit desired. M-Pak Modular Packages are available for prompt delivery in capacities from 7½ to 150 tons.

BELL & GOSSETT COMPANY
Dept. RGW-5, Morton Grove, Ill.
Canadian Licensee: S. A. Armstrong, Ltd.,
1400 O'Connor Drive, Toronto 16, Ontario

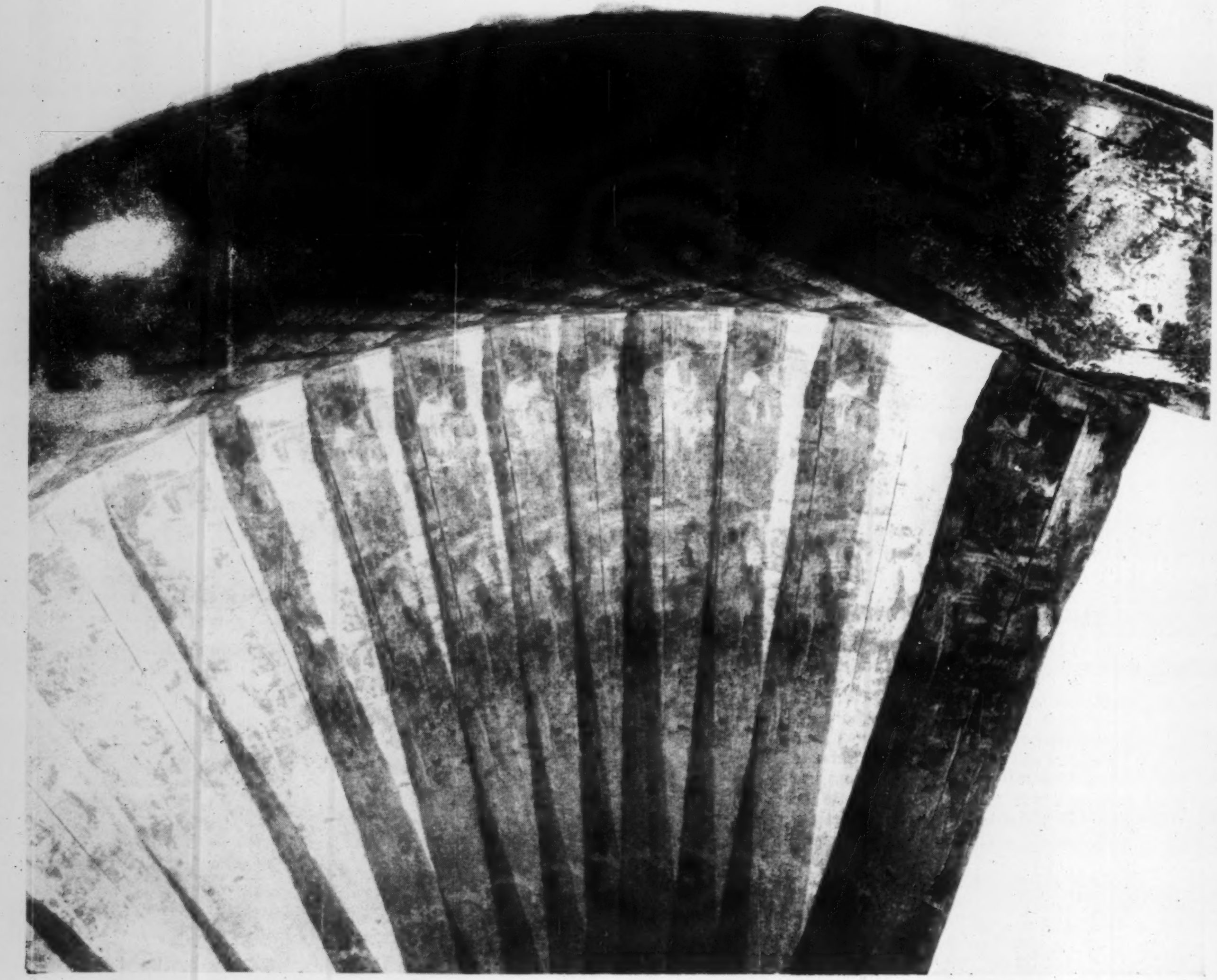
B&G Compressor


B&G Motor Compressor

B&G Condensing Unit


B&G Package Liquid Cooler

–that's **WALWORTH DUCTILE IRON VALVES!** Walworth's special ductile iron alloy offers steel-like strength and toughness. That's why these valves are practically "shatterproof"–with exclusive Walworth Valve quality for good measure! ■ Think of **WALWORTH DUCTILE IRON VALVES** wherever your valves face unusual flexing conditions – and where economy is a consideration.

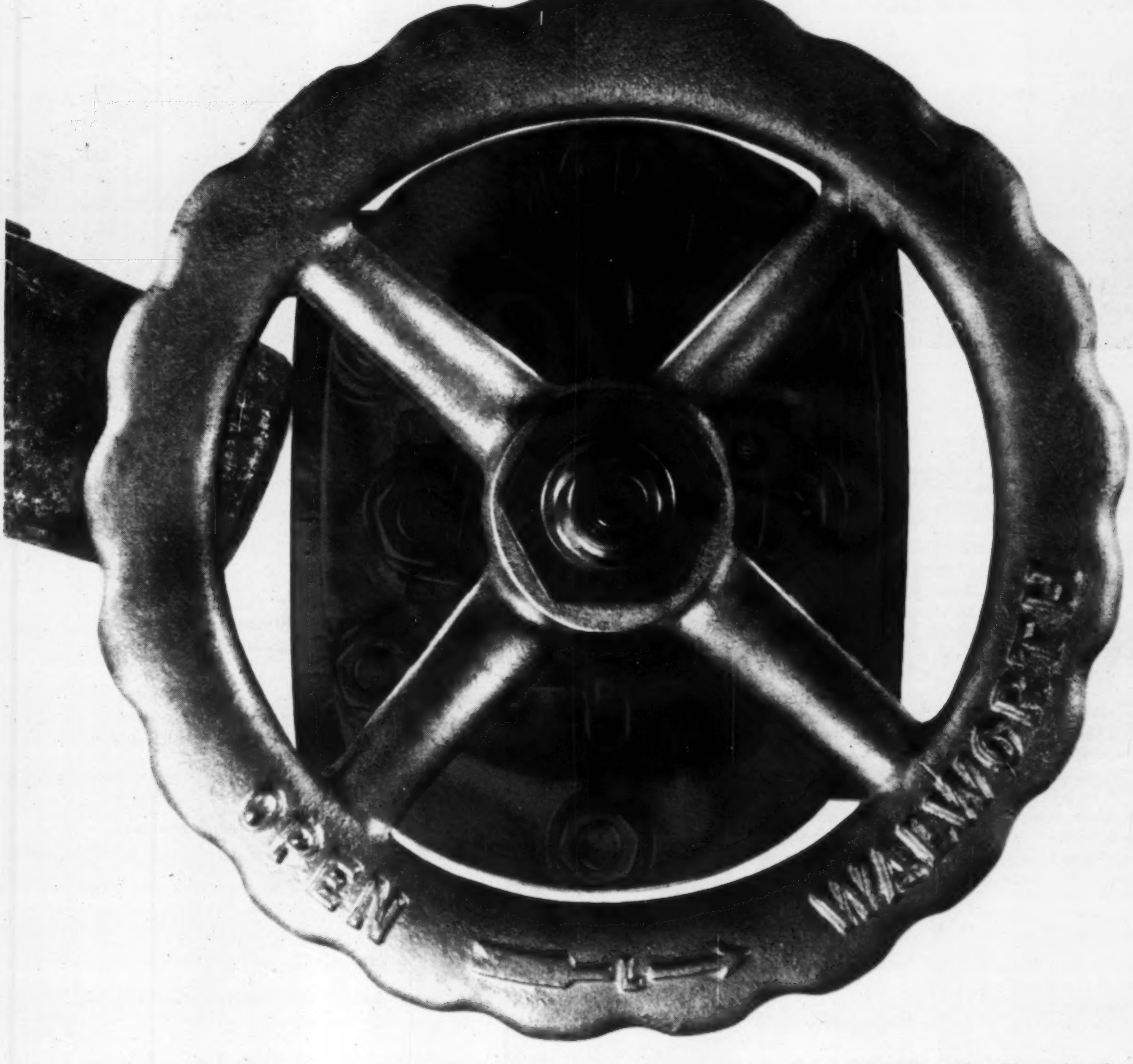


WALWORTH DUCTILE IRON VALVES are now available in gate, globe, check and angle types...2"-24"...in ASA 150 and 300 lb. classes. See your Walworth distributor, or write Walworth Company, 750 Third Ave., New York 17, N.Y.

WALWORTH

the Walworth companies: Alloy Steel Products Co. · Conoflow Corp. · Grove Valve & Regulator Co. · M&H Valve and Fittings Co.

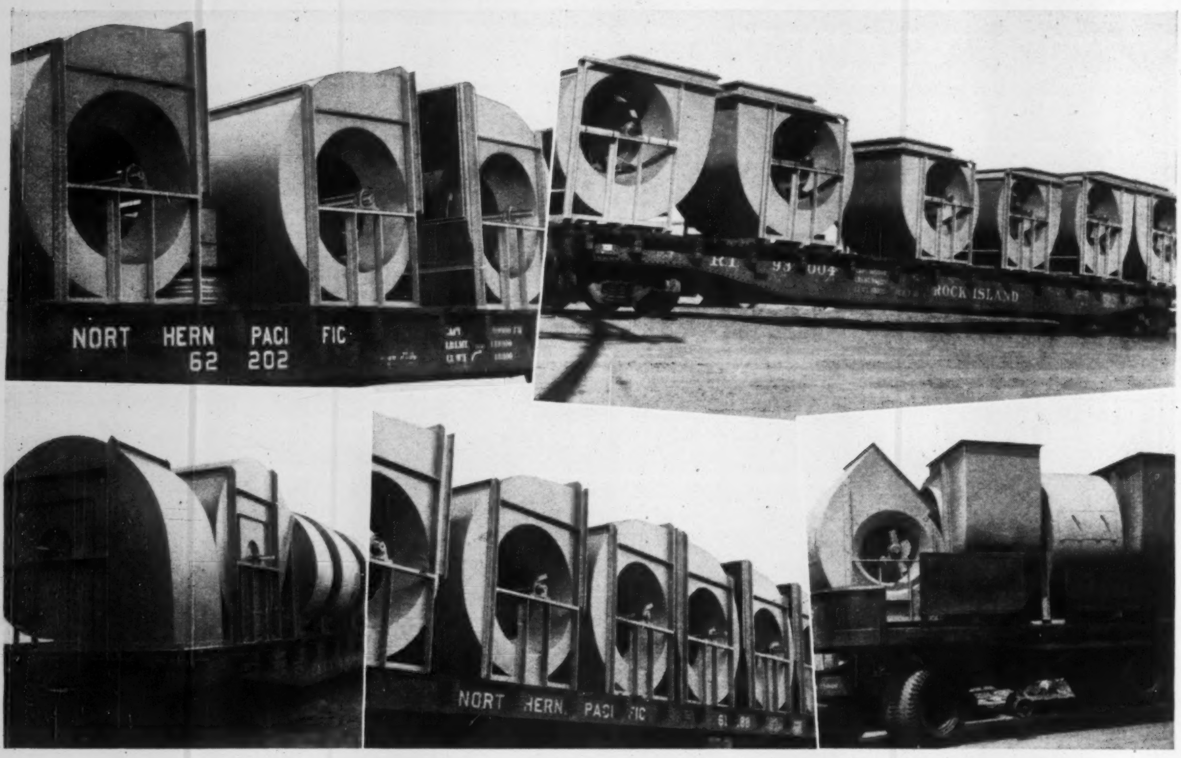
Shatterproof!



*Walworth specifies minimum elongation of 18%

for your large air moving requirements . . .

CALL ON BARRY FOR THE BIG ONES!



BARRY

centrifugal fans are engineered to do the job *RIGHT!*

Yes, big air moving jobs can bring big headaches . . . unless your blower supplier can give you fast delivery on fans that will do the job right. That's where Barry's experience pays off for you!

Barry builds a lot of big fans, and Barry's know-how assures you of speedy delivery on every big blower project. And the same inherent precision, good design, perfect balance and overall attention that regularly goes into our smaller fans will also be found in our larger units.

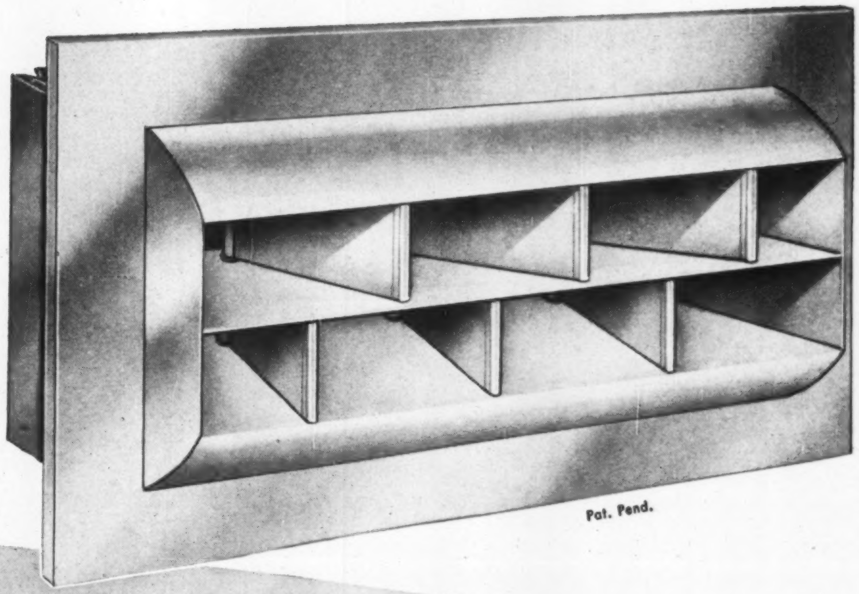
Whenever you require big volume fan equipment—see your Barry representative. And even if your fan needs are not as large as the blowers shown here, your Barry representative can help you solve all your problems quickly and efficiently!

fast delivery too!—on fans in all classes from I to IV:—
check with BARRY first, you'll save time and money!

member of air moving and
conditioning association inc.

BARRY BLOWER CO.
3100 CALIFORNIA ST. N. E., MINNEAPOLIS 18, MINN.

FC VENTILATING FANS • INDUCED DRAFT FANS • STEEL PLATE FANS • FAN WHEELS AND SCROLLS • BBC VENTILATION FANS • FORCED DRAFT FANS • FUME EXHAUST FANS • UTILITY EXHAUSTERS • BELTED VENTILATING SETS • MATERIAL HANDLING FANS • MEDIUM PRESSURE BLOWERS • SPECIAL APPLICATIONS



WITH
ENGINEERED
JET
INDUCTION
DIFFUSING
VANES

EXTRUDED ALUMINUM

AGITAIR® ROTO-JET diffusers

FOR LONG PROJECTION OR MODULATED DIFFUSION
ADJUSTABLE — UP OR DOWN . . . LEFT OR RIGHT

Agitair ROTO-JET Diffusers designed and developed by Air Devices Inc. engineers are recommended for those applications where long projection or modulated diffusion of heated or cooled air must be directed to cover extremely large interiors.

The versatility of these diffusers permits distribution of air in an upward or downward projection, also left or right when desired. ROTO-JET Diffusers can be mounted either horizontally or vertically.

Your local Air Devices Inc. representative, with practical on-the-job engineering experience in air distribution, is prepared to assist you in the application and sizing of ROTO-JET diffusers to meet your requirements.

Your Best Bet Is ROTO-JET

For use in . . . factories • gymnasiums • auditoriums • sport centers • supermarkets • bowling alleys • missile plants • aviation plants • airport terminals • power plants • automobile factories elevator switching and machine rooms; as air curtains. Ideal for use in any other structure where large interior areas must be blanketed with heated or cooled air.

FEATURES:

ROTARY CYLINDER — The rotating cylinder permits the projection of air upward or downward 30° from the centerline. This feature is ideal for those applications where long projection or modulated diffusion of heated or cooled air must be directed to cover extremely large interiors.

ADJUSTABLE DIFFUSING VANES — Only cylinder type ROTO-JET diffusers employ the individually and manually adjustable split diffusing vanes.

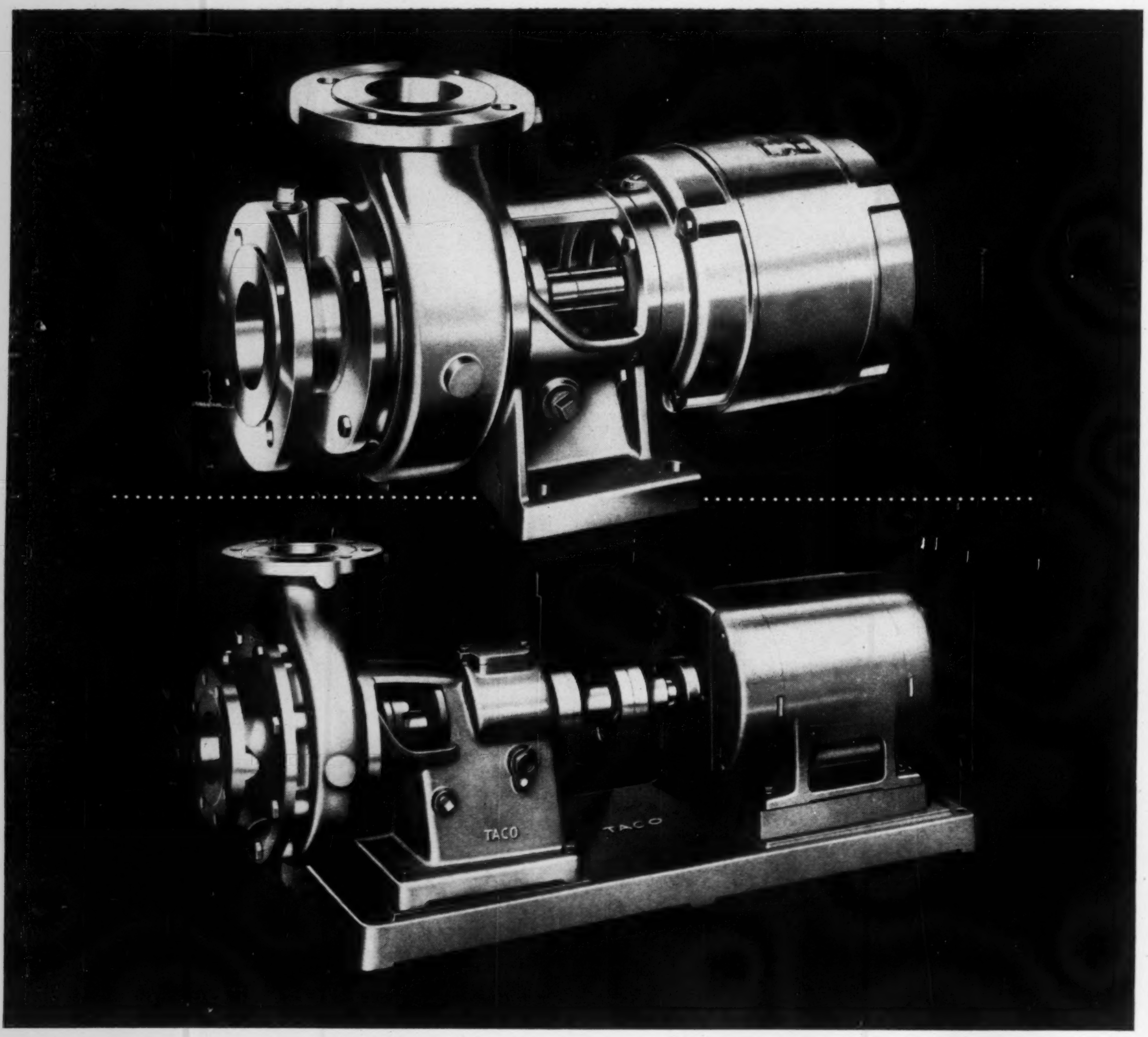
For long projection applications, the vanes are set straight out producing nozzle type throws.

When vanes are set at angles diverging from the centerline, the degree of spread may be controlled.

MODULATED DIFFUSION — The split vanes design provides an additional feature only employed in ROTO-JET DIFFUSERS. When the top row of vanes are adjusted to the left or right and the bottom vanes are in opposite directions, they produce diverging and counter-flowing jet air streams which create a high degree of turbulence, instantaneously mixing the primary and room air and resulting in rapid temperature equalization. The length of blow may be extended or shortened according to the amount of counter-flow resulting from vane settings.

SEND FOR CATALOG RJ-100

AIR DEVICES INC.
185 MADISON AVENUE, NEW YORK 16, N. Y.
BETTER PRODUCTS FOR
AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST



ANNOUNCING . . .
Two New Total Efficiency Hydronic Pumps

Few qualities promote more confidence in mechanical equipment than quiet operation. It is almost a certain sign of smooth, trouble-free functioning. And exceptionally quiet operation — keynotes the total efficiency of these new TACO Hydronic Pumps.

These TACO Close Coupled and Base Mounted Pumps come in sizes suitable for all commercial buildings, smallest to largest. They feature mechanical seals . . . center line discharge casings for automatic air venting (vertical position) . . . rotatable casings for other discharge positions and cupro-nickel shaft sleeves. In addition to a wide range of other "extras", these pumps come equipped with diffuser sections — designed as part of the pump casing — which enables the discharge and suction connections to be of equal size. This allows for simpler piping by making it unnecessary to use a reducer.

All models are tested and rated in accordance with the procedures of the Hydraulic Institute. Further refinements for special requirements are available at nominal extra cost. It will pay you to investigate these new TACO "efficiency engineered" Hydronic Pumps for your future installations. For further information contact your wholesaler or write TACO HEATERS, INC., 1160 Cranston St., Cranston 9, Rhode Island. Ask for TACO Catalogs 300-3 and 300-4.

Taco

EFFICIENCY ENGINEERED PRODUCTS

DEKORON POLY-COR *Instrument Harness specified for new* GENERAL TELEPHONE COMPANY *building*

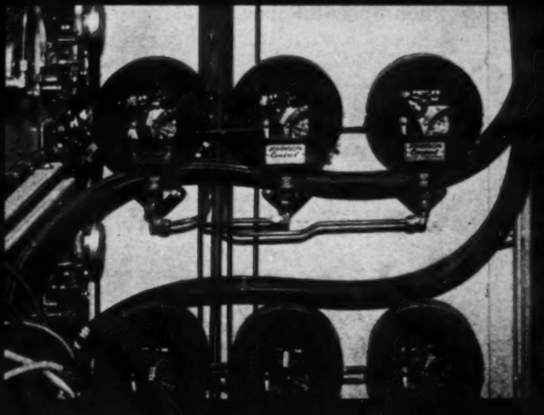
Architect Engineer: Steven Berkey Co. • *Air Conditioning Contractor:* F. B. Gardner Co.
Air Conditioning Controls Contractor: Johnson Service Co.

Typical of the swing to new Dekoron Poly-Cor all-plastic instrument harness for air conditioning control lines is the new General Telephone Company building at Pomona, Calif.

Poly-Cor is the most advanced instrument line harness made . . . now offers features never before available. New all-black polyethylene for higher temperature operation . . . number coded tubes for faster, easier installation . . . Mylar* vapor barrier. All these features are now standard in new Poly-Cor at no increase in price.

For faster, neater tubing bundle installations, check your local Dekoron products representative. Dekoron products are application-engineered by the company with the greatest application experience.

Rear view of central control panel, located over 600 feet from air conditioning equipment, shows neat installation of Poly-Cor which can be strung like electric wiring without complicated tube bending problems. →



A-4744A

Dekoron *products*

quality • research • service

SAMUEL MOORE & COMPANY

DEKORON PRODUCTS DIVISION • **MANTUA, OHIO**

PROCESS PIPING STANDARDS HAVE CHANGED

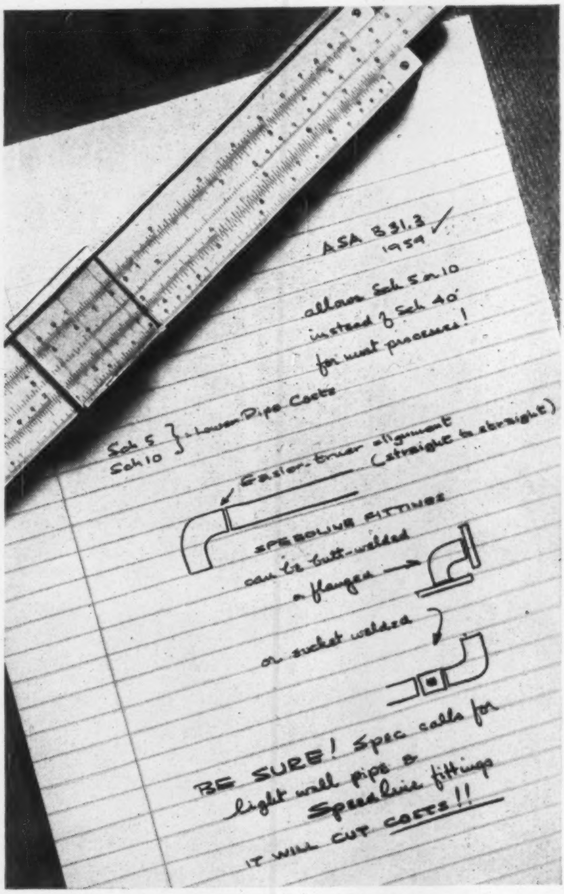
IT WILL PAY YOU TO BE UP-TO-DATE

If you're familiar with the latest issue of the Code for Pressure Piping ASA B31.3, you know process piping standards have changed. Pressure-Temperature operating conditions should be re-evaluated. Now *your* specifications can take advantage of economical *light wall* pipe and improved *Speedline fittings design* to meet the most critical process line requirements!

Once you "up-date" your specifications via this new code, important cost savings follow *down the line.* Savings in materials cost are definite—Schedules 5 and 10 stainless pipe simply *costs less.* Speedline fittings design accounts for significant additional savings in the total installed cost.

The Speedline "extra length" feature makes it easier to butt-weld joints . . . assures faster, truer alignment every time because connections are always made "straight to straight". All types of flanged connections, too, can be made more readily . . . without fouling problems—even welding can be eliminated with Speedline Insert Flanges—just roll them on.

Speedline's design advantages give complete freedom of choice—you can butt-weld, flange, socket weld or use unions . . . and *one fitting* can be used *all ways* when Speedline is specified.


ASA B31.3 1959 ✓
allows Sch 5 or 10 instead of Sch 40 for most processes!
Sch 5
Sch 10
= Lower Pipe Costs
Easier-Truer alignment (straight to straight)
SPEEDLINE FITTINGS can be butt-welded or flanged
or socket welded
BE SURE! Spec calls for light wall pipe & Speedline fittings
IT WILL CUT COSTS!!

Real economy in process piping is a matter of *specifications*—and Speedline fittings. Make the most of *both.* Study ASA B31.3-1959 for up-to-date data on light wall lines for *your* application. Get detailed data on bonus savings possible *only* with Speedline corrosion-resistant fittings. The Speedline Distributor near you is listed on Page 1494 of Chemical Engineering Catalog. Call him today.

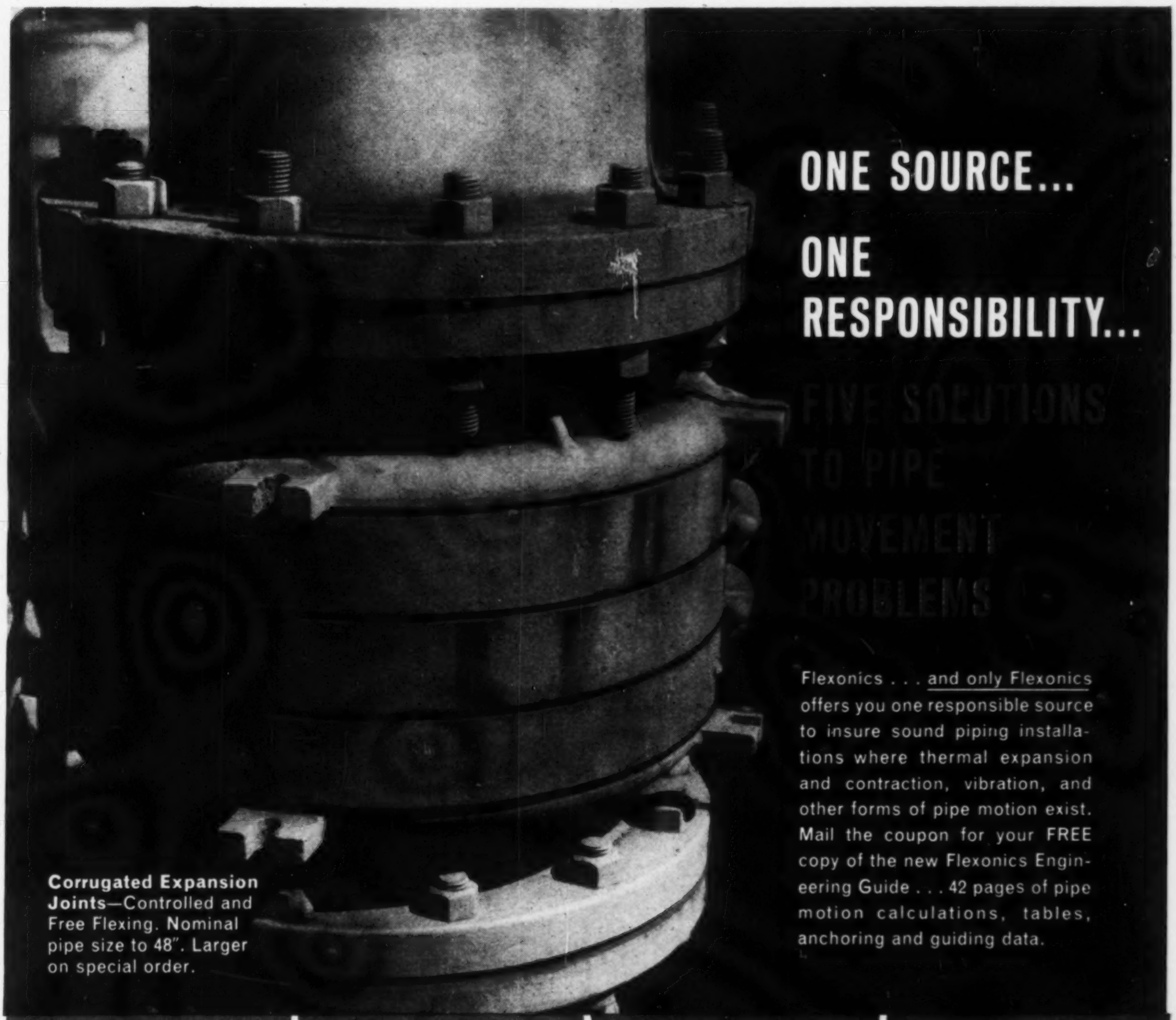
Speedline®

CORROSION-RESISTANT FITTINGS

STAINLESS STEEL • ALUMINUM • SPECIAL ALLOYS

200

A PRODUCT OF HORACE T. POTTS COMPANY • 576 E. ERIE AVENUE, PHILADELPHIA 34, PA.



ONE SOURCE...

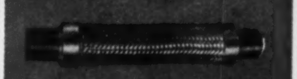
ONE RESPONSIBILITY...

FIVE SOLUTIONS TO PIPE MOVEMENT PROBLEMS

Flexonics . . . and only Flexonics offers you one responsible source to insure sound piping installations where thermal expansion and contraction, vibration, and other forms of pipe motion exist. Mail the coupon for your FREE copy of the new Flexonics Engineering Guide . . . 42 pages of pipe motion calculations, tables, anchoring and guiding data.

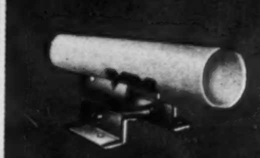
Corrugated Expansion Joints—Controlled and Free Flexing. Nominal pipe size to 48". Larger on special order.

Expansion Compensators—Low and high pressure models. Available in steel, all stainless steel, and bronze.



Flexible Connectors—Bronze and hot dipped galvanized steel. Pipe size to 14". Nipple, weld, or flange ends.

Pipe Alignment Guides—All steel construction of pipe size ¾ to 14". Moves axially in segmented steel cylinder.



Roller Pipe Insulating Supports—All steel, formed saddle. Pipe sizes ½" to 14". Larger sizes on special order.

EJ-280

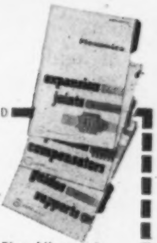
Flexonics

DIVISION OF CALUMET & HECLA, INC.
290 East Devon Avenue • Bartlett, Illinois

FLEXIBLE METAL and SYNTHETIC HOSE
EXPANSION JOINTS
BELLOWS • SPECIAL TUBULAR ASSEMBLIES

In CANADA
FLEXONICS CORPORATION OF CANADA, LTD.
BRAMPTON, ONTARIO

C&H

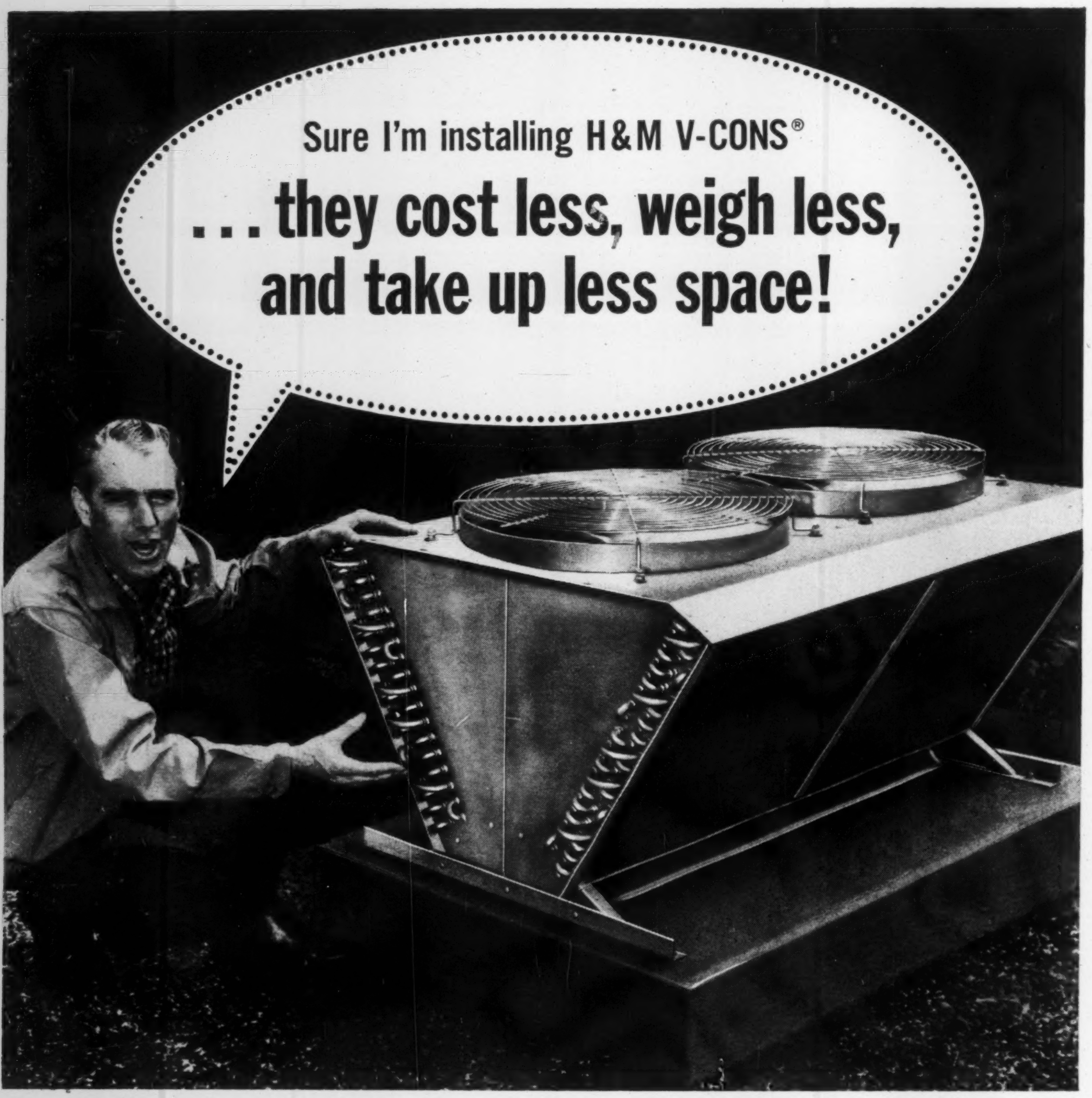


ATTACH TO YOUR LETTERHEAD

Flexonics
290 E. Devon Ave.
Bartlett, Ill.

Please send me Flexonics Engineering Guides and other information in the areas that I have checked:

☐ Flexonics Expansion Joints
☐ Pipe Alignment Guides & Supports
☐ Flexonics Expansion Compensators
☐ Flexonics Flexible Connectors


Sure I'm installing H&M V-CONS®
. . . they cost less, weigh less, and take up less space!

No wonder these Halstead & Mitchell V-Cons® are the hottest selling air-cooled condensers around. First off, they give full performance yet cost up to 15% less than comparable capacity condensers.

Second, they weigh about half as much because they are housed in light-weight, corrosion-resistant aluminum. The fan blades are aluminum, too. Thus, roof loading is much lower and rigging far easier.

Next, they combine the low height and quiet operation of vertical discharge condensers with the minimal space requirements of horizontal discharge units.

Currently available in 3, 5, 7½, and 10 ton sizes, these new units round out Halstead & Mitchell's line of vertical and horizontal discharge condensers of 3 to 100 ton capacity. All models feature H&M's exclusive Turbu-Flo fins, which improve heat transfer between refrigerant and air.

For more information, contact your wholesaler, or write for Bulletin VC-103. Halstead & Mitchell Co., Dept. C-11, Bessemer Bldg., Pittsburgh 22, Pa.

HM

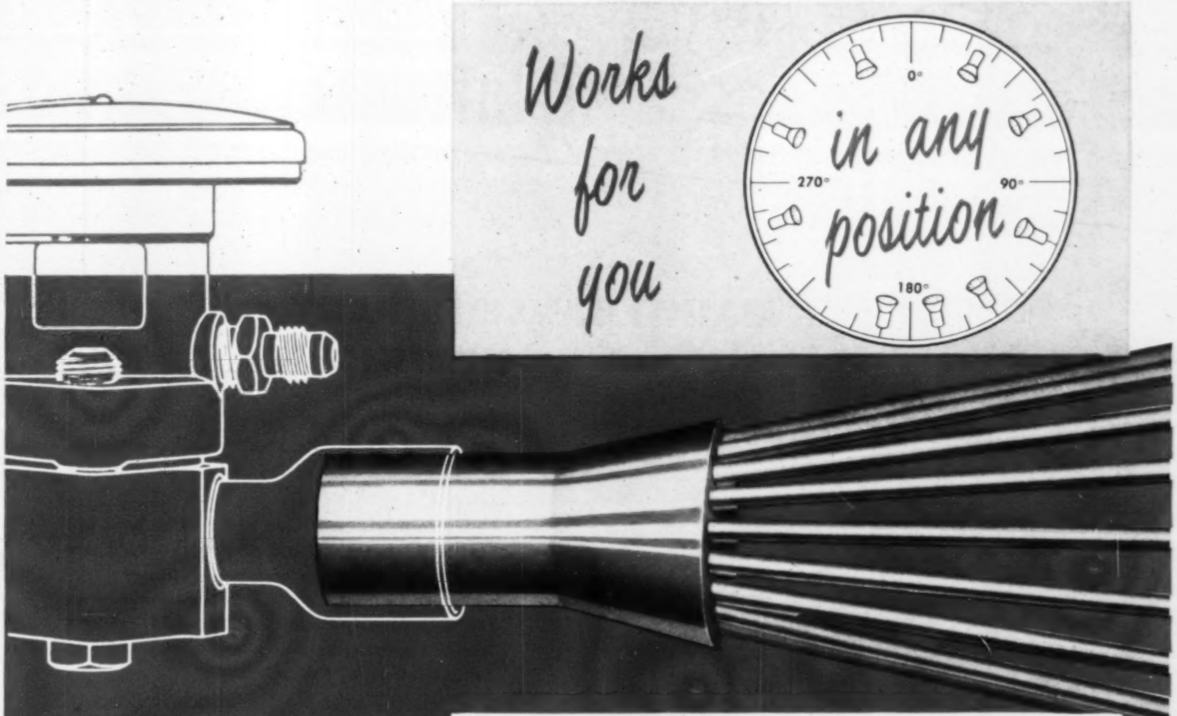
Halstead & Mitchell

Air-Cooled Condensers • Water-Cooled Condensers • Cooling Towers • Air Handlers and Coils

Export Representative: Sabal-Kielmann, 15 Williams Street, New York, New York

CHECK THE ADVANTAGES...THEN SPECIFY • INSTALL

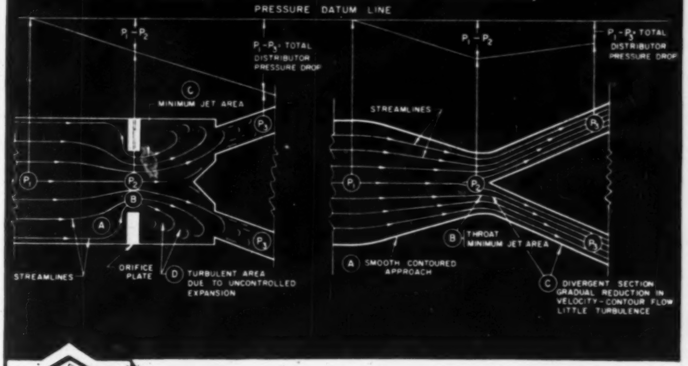
ALCO'S NEW VENTURI-FLO® DISTRIBUTOR


Works for you
in any position
0°
90°
180°
270°

COMPARE THE FLOW:

FIG. #1 — FLOW THRU AN ORIFICE PLATE
No Pressure Recovery — High Pressure Drop

FIG. #2 — FLOW THRU A VENTURI
Pressure Recovery — Low Pressure Drop


PRESSURE DATUM LINE
P1 – P2
P1 – P3 = TOTAL DISTRIBUTOR PRESSURE DROP
C MINIMUM JET AREA
P1
P2
P3
B
A
STREAMLINES
ORIFICE PLATE
D TURBULENT AREA DUE TO UNCONTROLLED EXPANSION
P1 – P2
P1 – P3 = TOTAL DISTRIBUTOR PRESSURE DROP
STREAMLINES
P1
P2
P3
B THROAT MINIMUM JET AREA
A SMOOTH CONTOURED APPROACH
C DIVERGENT SECTION GRADUAL REDUCTION IN VELOCITY – CONTOUR FLOW LITTLE TURBULENCE

Assures equal distribution to all passes of a multi-circuit evaporator with a low pressure drop.

WIDE APPLICATION RANGE—from 25% to 150% of Rated Capacity.

LOW PRESSURE DROP—permits closer, more economical Thermo® Valve sizing—assures more stable valve control.

ONE PIECE CONSTRUCTION—nothing to come apart, nothing to take apart—*No orifices, plates or nozzles needed* for capacity regulation.

Call your Alco wholesaler—
write for Specifications Bulletin No. 188.57.

ALCO

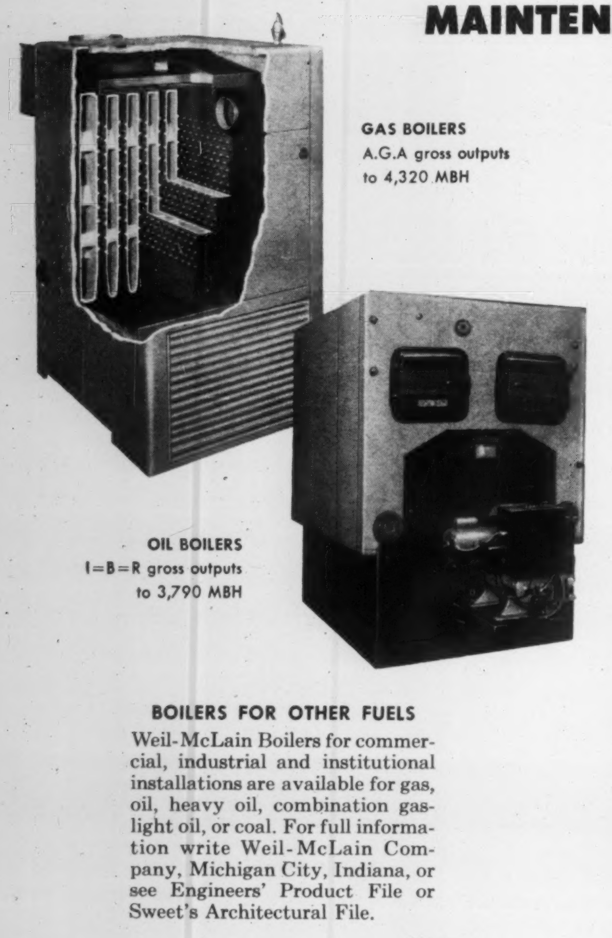
- *BUY SECURITY*
- *BUY QUALITY*
- *BUY ALCO*

8219

ALCO VALVE CO.
861 KINGSLAND AVE. • ST. LOUIS 5, MO.

The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributors Solenoid Valves • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves

MAINTENANCE IS PART OF HEATING PLANT COST



GAS BOILERS
A.G.A gross outputs
to 4,320 MBH

OIL BOILERS
I=B=R gross outputs
to 3,790 MBH

Over the life of a boiler, original and operating cost are only part of the total expense. Maintenance cost also can become a major item.

In Weil-McLain Gas and Oil Boilers are features of design and material which are warranties of minimum maintenance.

These boilers have no tubes which must be periodically replaced...do not require water treatment...and are easily cleaned for retention of full efficiency.

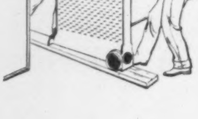
From the stand-point of repairs, maintenance expense is minor. Weil-McLain Boilers are built of *cast iron*...strongly resistant to corrosion...immune to usual causes of boiler breakdown. Any possible service work does not require expensive welding and inspection...and an operating engineer is not needed.

A Weil-McLain sectional boiler also provides a hedge against future needs. If additional capacity is required, a second boiler can be installed to supplement the original boiler, or additional sections installed in the present boiler...in either case without need for structural alterations.

BOILERS FOR OTHER FUELS

Weil-McLain Boilers for commercial, industrial and institutional installations are available for gas, oil, heavy oil, combination gas-light oil, or coal. For full information write Weil-McLain Company, Michigan City, Indiana, or see Engineers' Product File or Sweet's Architectural File.

The sections of any Weil-McLain Gas or Oil Boiler, regardless of capacity, can be moved through an ordinary doorway.



WEIL-McLAIN
CAST IRON BOILERS
"BOILERS WITH A FUTURE"

WEIL-McLAIN COMPANY, INC. • DEPT. AA-111 • MICHIGAN CITY, INDIANA

The refrigerants you want... packaged the way you want them! Take your pick!

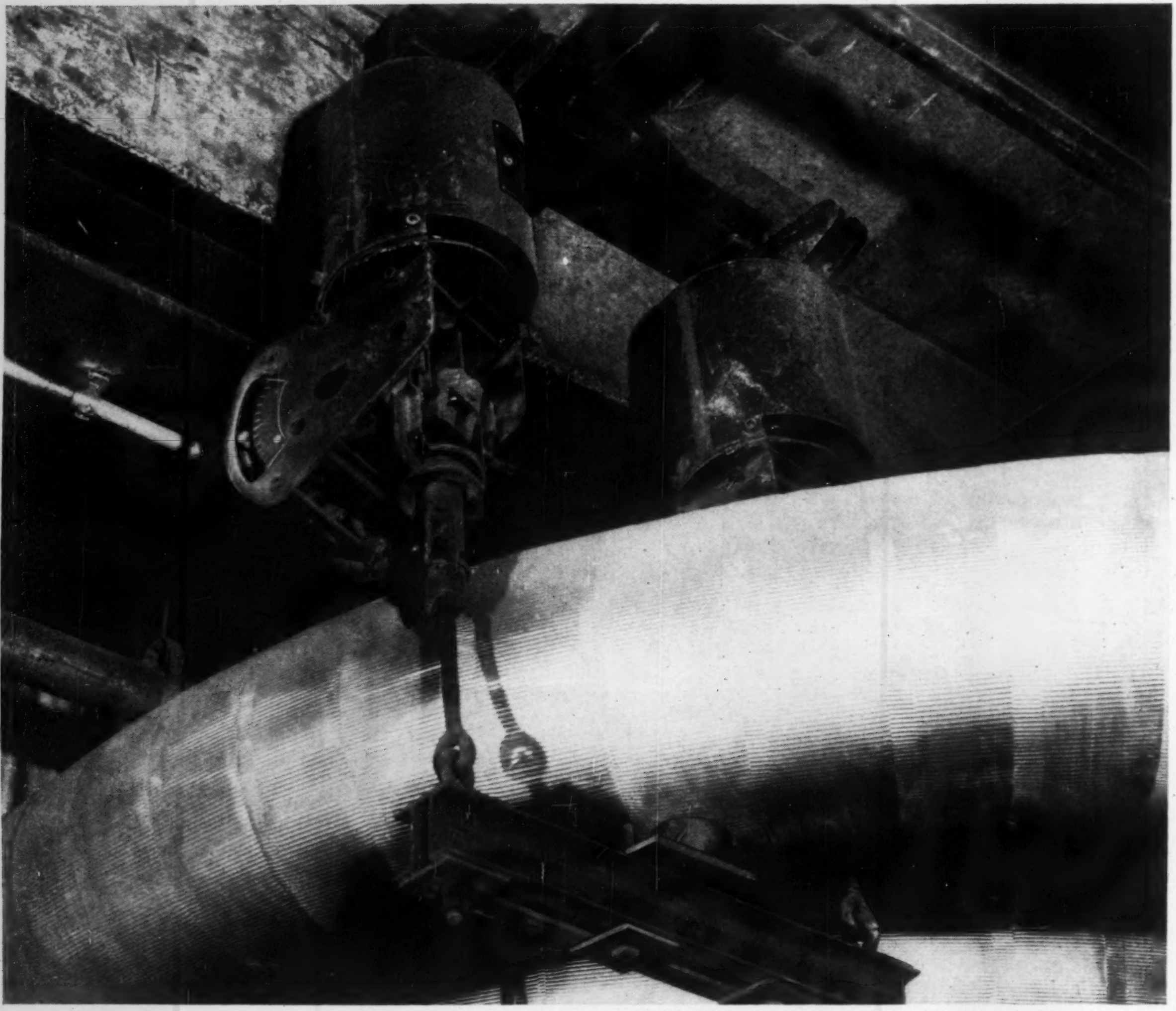
genetron
SUPER-DRY REFRIGERANTS

genetron 11	CCl_3F	ORANGE LABEL	TRICHLOROMONOFLUOROMETHANE
genetron 12	CCl_2F_2	WHITE LABEL	DICHLORODIFLUOROMETHANE
genetron 22	$CHClF_2$	GREEN LABEL	MONOCHLORODIFLUOROMETHANE
genetron 113	$C_2Cl_3F_3$	PURPLE LABEL	TRICHLOROTRIFLUOROETHANE
genetron 114	$C_2Cl_2F_4$	BLUE LABEL	DICHLOROTETRAFLUOROETHANE

NEW! Get facts about "Genetron" 11 solvent in special pressurized cylinders for cleaning out mildly contaminated systems following burnout.

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.



Space-saving Grinnell Hangers snugly support hot piping in cramped places.

Hot-to-handle piping . . . little space to spare . . . both problems solved with Grinnell Pipe Hangers

Grinnell Hanger assemblies support feedwater piping at 500,000-kw. power station

American Electric Power Company's 500,000-kw Philip Sporn Station, Unit No. 5 at New Haven, West Va., is one of America's largest power stations. The feedwater piping from the heater to the steam generator presented especially difficult heat and space problems for pipe supports — problems solved by Grinnell Pipe Hangers.

The 14-inch feedwater piping — with walls 1-13/16 inches thick — heats up to 560°F . . . takes pressures up to 4860 PSI. What's more, the piping runs unusually close to ceilings and beams!

To keep reactive forces at terminal points within specified limits, space-saving Grinnell Constant Support Hangers are used. Where piping is subject to vertical movement but does not require a constant support type, Grinnell Variable Spring Hangers are used. In fact, more than 1700 Grinnell Hangers were engineered for the Philip Sporn Station!

Grinnell can solve *your* pipe support problems, too. Grinnell designs, manufactures and supplies a complete line of pipe hangers and supports . . . offers design assistance and field engineering service. Write Grinnell Company, Inc., Providence 1, Rhode Island.

GRINNELL

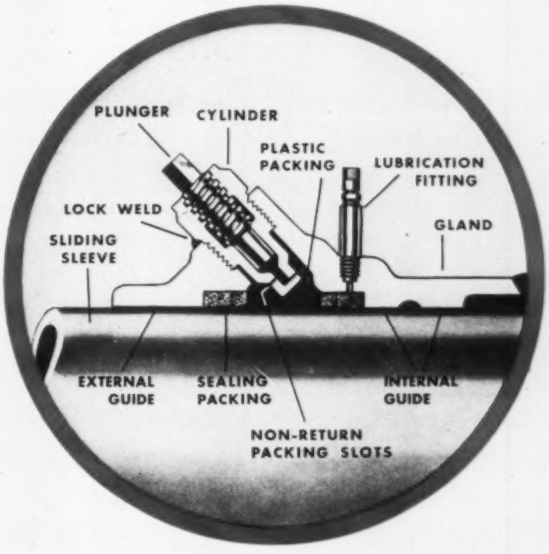
AMERICA'S LEADING SUPPLIER OF PIPE HANGERS AND SUPPORTS

YARWAY Y *news briefs*

from **Yarnall-Waring Company,** *Philadelphia 18, Pa.*

BRANCH OFFICES IN 19 UNITED STATES CITIES • SALES REPRESENTATIVES THROUGHOUT THE WORLD

WITH YARWAY GUN-PAKT EXPANSION JOINTS YOU NEVER HAVE TO SHUT DOWN STEAM LINES


PLUNGER
CYLINDER
PLASTIC PACKING
LUBRICATION FITTING
LOCK WELD
GLAND
SLIDING SLEEVE
EXTERNAL GUIDE
SEALING PACKING
INTERNAL GUIDE
NON-RETURN PACKING SLOTS

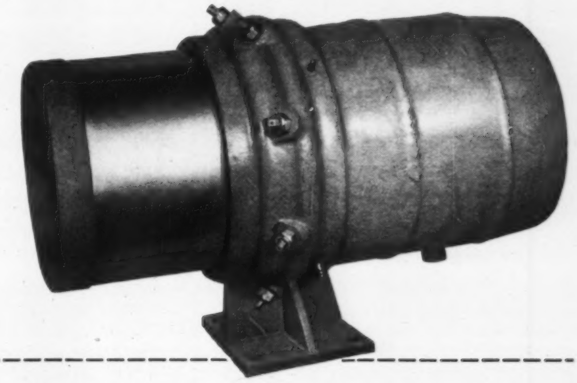
With Yarway Gun-Pakt Expansion Joints it is *never* necessary to shut down the lines to add packing to the joints. When additional packing is needed it is added *with the pipe line under full pressure.* A slug of plastic packing is inserted in the convenient screw-plunger gun—a turn of a wrench and the job is done, the joint is tight. Steam service is continuous. Costly shutdowns are eliminated. Joints never need repacking.

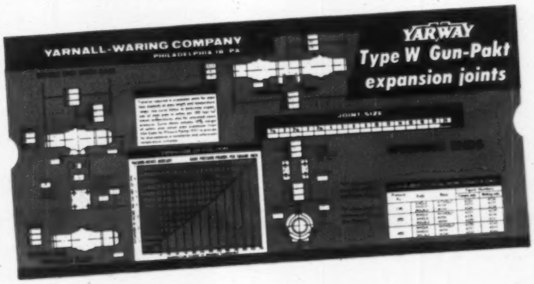
Yarway Gun-Pakt Expansion Joints give users these *extra* advantages, too:

- **Rugged dependability**—All-steel construction. Durable chromium plated seamless steel sleeves. *No chance of metal fatigue.* Wrought steel bases for positive anchorage.
- **Internal and external guides**—provide positive alignment in the stuffing box—*where it counts.*
- **Light weight, streamlined design**—requires less space to install, less space to maintain, smaller manholes.

Accept no substitute! Insist on Yarway Gun-Pakt—the original "packed under pressure" expansion joint, backed by 20 years of experience and thousands of successful installations to its credit.

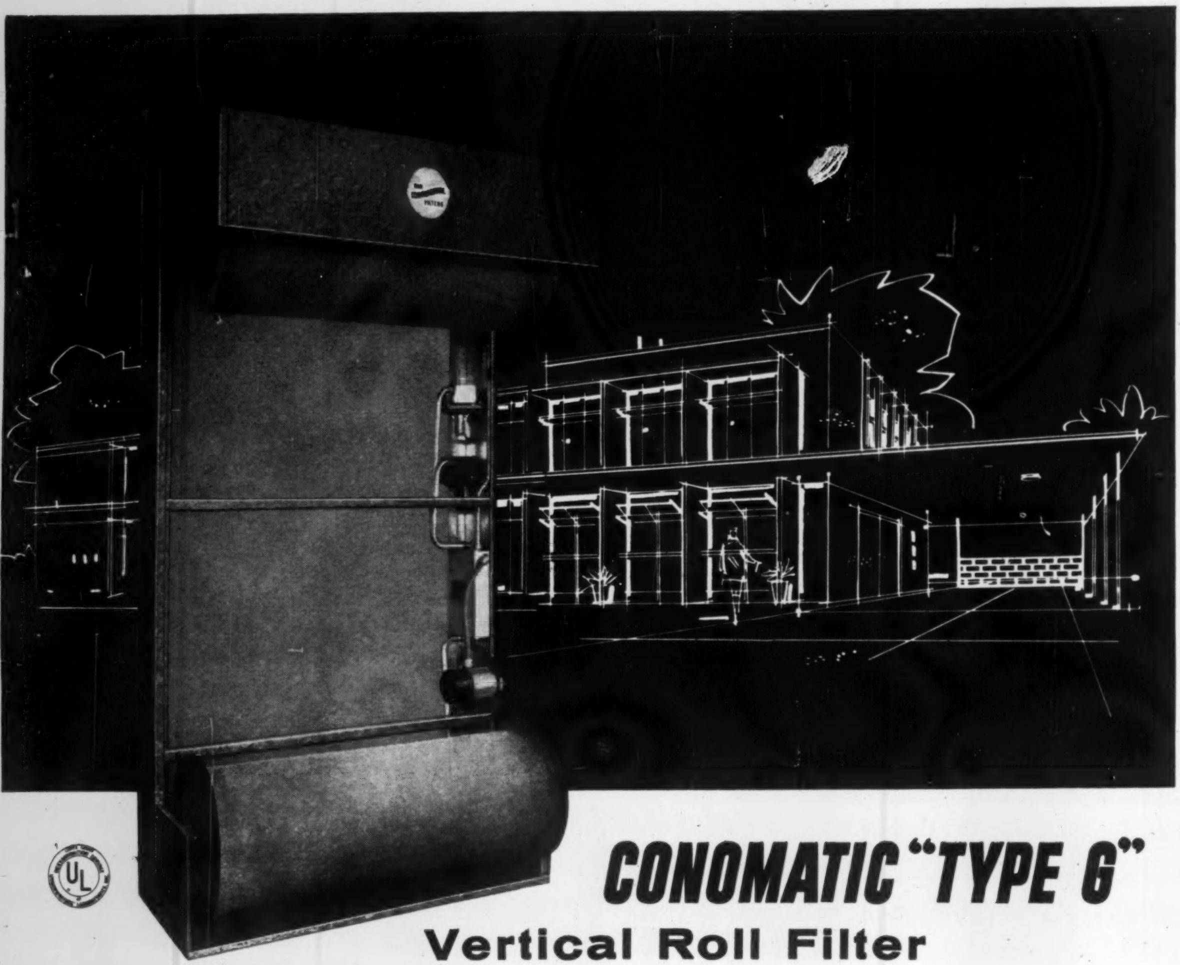
For full information, and "blue chip" list of industrial plants, universities, institutions and central plants using Gun-Pakt Joints, write to Yarway.




YARNALL-WARING COMPANY
PHILADELPHIA 18, PA
YARWAY
Type W Gun-Pakt expansion joints
JOINT SIZE

QUICK ANSWERS TO EXPANSION JOINT PROBLEMS

Want a *new* time- and labor-saving Yarway Expansion Joint Calculator which quickly provides sizes, weights, dimensions, anchor loads, etc. for Yarway Gun-Pakt Joints? Just call your Yarway representative and ask for one—or write us on your company letterhead and we'll see that one is delivered.



CONOMATIC "TYPE G"

Vertical Roll Filter

Now your entire air system can be automatic!

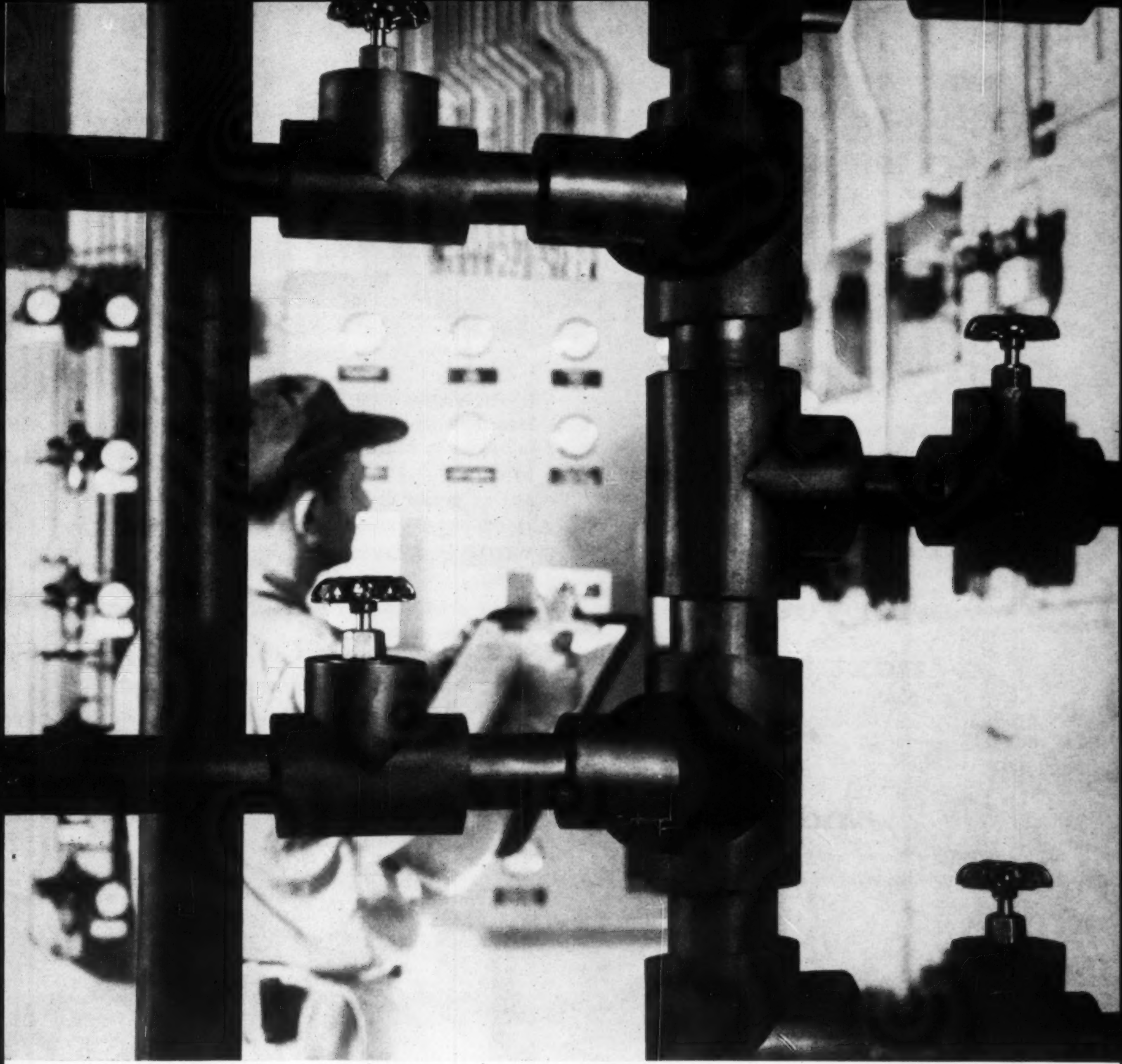
Continental's CONOMATIC vertical roll-type air filter assures you that your equipment will *continue* to perform properly. Fully automatic in maintaining filtering efficiency, the CONOMATIC keeps your air system at a "good-as-new" operating peak.

You *save* with CONOMATIC—in time, in money—because the unit is factory-assembled for fast and lowest-cost installation. And virtually no maintenance is required. Specify this fully automatic vertical-type roll filter! For complete facts, ask your Continental Agent, or write to us at P. O. Box 1647, Louisville 1, Ky., for Bulletin 819a.

Clean Air Costs Less with Continental!

- **Matches the job. Available in any size needed.**
- **Capacities from 5,240 cfm up.**
- **Access from the entering-air side for all servicing.**
- **"Ready-to-run" when delivered to you. Completely assembled. Completely wired.**
- **Underwriters Listed—for safety, for quality.**
- **Galvanized or cadmium-plated throughout.**
- **Totally-enclosed drive motor, with built-in overload protection.**
- **Non-reversing air flow through media—eliminates dirt "blow-off"!**
- **Control choices: either timers or pressure switches.**
- **CONOMATIC Horizontal "Type GH" also available.**

C A F CONTINENTAL AIR FILTERS, INC.
LOUISVILLE 1, KENTUCKY



Here's a better, faster way to insulate fittings

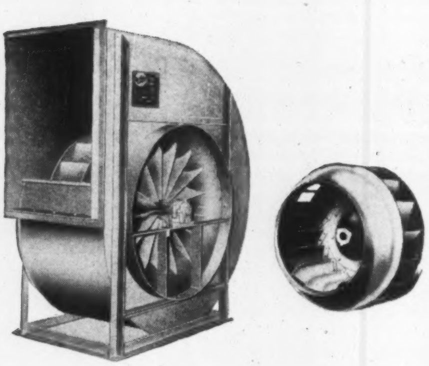
The more fittings there are, the more time you save by using Armstrong Armaflex 22 Insulation—and you get a better job, too. Fitting covers are made from pieces of flexible pipe covering, miter-cut and assembled with adhesive. In application, they're simply snapped over the fittings, and joints are sealed. The job is fast, clean, good looking, long lasting, and thermally efficient.

Armaflex 22 Pipe Insulation is one of a complete line of Armstrong products that includes Armaflex Sheets, Rigid Armaflex, Armaflex Finish and Adhesives. For a copy of the Armaflex Specifier Portfolio, which contains comprehensive product and engineering data on the Armaflex line, write today to Armstrong Cork Company, 2211 Sherman Street, Lancaster, Pennsylvania.

ARMAFLEX ® IS A TRADE-MARK OF ARMSTRONG CORK COMPANY

Armstrong INSULATIONS

ARMAFLEX 22 • RIGID ARMAFLEX • ARMAFLEX SHEETS • ARMAFLEX FINISH • ARMAFLEX ADHESIVES



BACKWARD CURVED BLADES provide high efficiency plus stable performance over the full capacity range

PROPERLY CURVED WHEEL SHROUD assures proper air flow in wheel

INLET BELL WITH INLET GUIDE VANES matches curve of wheel shroud for smooth, quiet entry path

EASY DUCT CONNECTION provided by ample inlet collar

NON-OVERLOADING! Select motor to h.p. rating without fear of over-loading

MANY OPTIONS — inlet and outlet dampers, high-temperature and/or non-sparking construction, special anti-corrosion coatings and materials

Put 'BUFFALO' BL on your next job... and

RELAX

It's the most proven, efficient fan in Class I and II construction.

Because of exclusive 'Buffalo' design and construction features, you can't buy a better or more reliable air supply for your ventilation or air conditioning system!

QUALITY CONSTRUCTION for a long, trouble-free service life.

WRITE FOR BULLETIN F-104-A and see why the 'Buffalo' BL is your ideal air supply on any Class I or II job!

"Buffalo"

AIR HANDLING DIVISION
BUFFALO FORGE COMPANY
Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

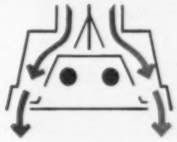
Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

THE MULTI-VENT SYSTEM OF LIGHTING AND AIR DIFFUSION

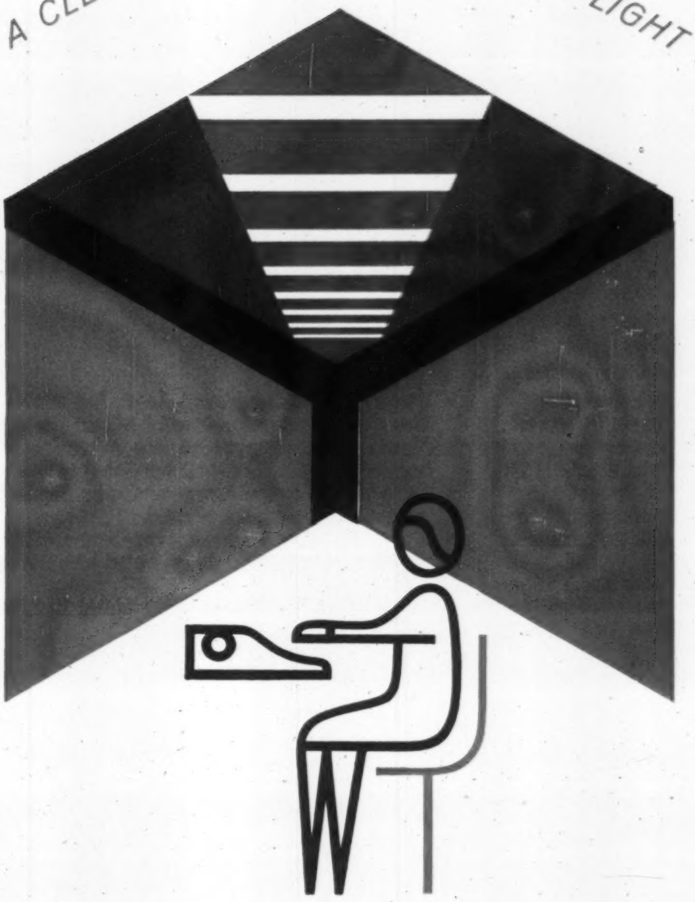
The "straight down flow" principle of the Multi-Vent system provides a uniform and balanced room atmosphere. Diffusing the air straight down at low velocity minimizes the mixing of the fresh air supply with the bad ceiling air and maintains a pleasant quiet working environment. The system is clean—no ceiling and wall smudging. The system is quiet—low velocity assures minimum drafts and low operating noise. For maximum human comfort always specify Multi-Vent. Write for Multi-Vent technical data.

THE MULTI-VENT SYSTEM GIVES YOU

More light output / Longer ballast life
True lamp color—all lamp types / Reduced maintenance
Superior room air-conditioning—no stagnation
Trade union approved installation procedure
Ease of installation—actual lowest cost
Quick, low cost air distribution balancing
Flexibility of wall placement—no rebalancing
No ceiling or wall smudging—lowest maintenance
Quietest air diffusion—no drafts
Lowest total cost—ask for our comparison data



A CLEAN AND QUIET SYSTEM OF LIGHT AND AIR DIFFUSION



THIS SYSTEM IS AVAILABLE FROM THE FOLLOWING MANUFACTURERS:

COLUMBIA

Columbia Lighting
Spokane, Washington

MILLER

The Miller Co.
Meriden, Connecticut

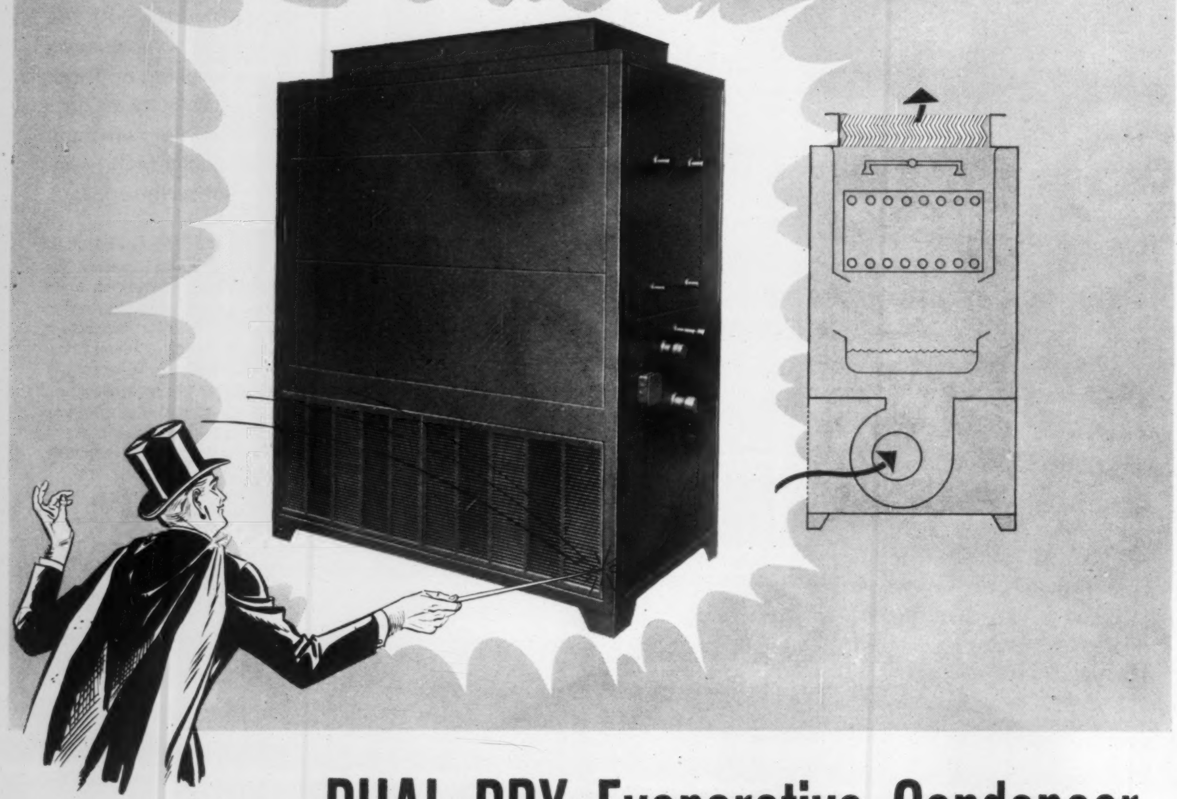
PYLE-NATIONAL

The Pyle-National Company
1334 N. Kostner Avenue
Chicago 51, Illinois

SYLVANIA

Sylvania Electric Products, Inc.
Wheeling, West Virginia

ENGINEERING MAGIC... 'DDEC'



DUAL-DRY Evaporative Condenser

DRY FAN DRY CASING

Here's the newest, most imaginative design concept the refrigeration industry's seen in years! The Dual-Dry Evaporative Condenser features blow-through dry fan construction; and the 'DDEC' is designed with a dry casing. The recirculating water is completely enclosed in a molded fiberglass liner and never contacts the outer steel casing.

Because the pump and water piping as well as the fans and fan motor are all factory installed within the dry casing the contractor saves installation time and money.

This fine unit incorporates many other superior features:

- Pump and water piping, fans, fan motor and drive are factory assembled within the casing. Thus, installation costs are minimized, protection provided for long service-free life.
- Coils are all prime surface copper. Eliminators and water piping are plastic.
- Dual casing and sound absorbing qualities of molded fiberglass provide unusually quiet operation.
- No steel in contact with the water in any part of the unit.

Capacities range from 10 to 100 tons.

Form 7020, free on request, contains complete specifications.

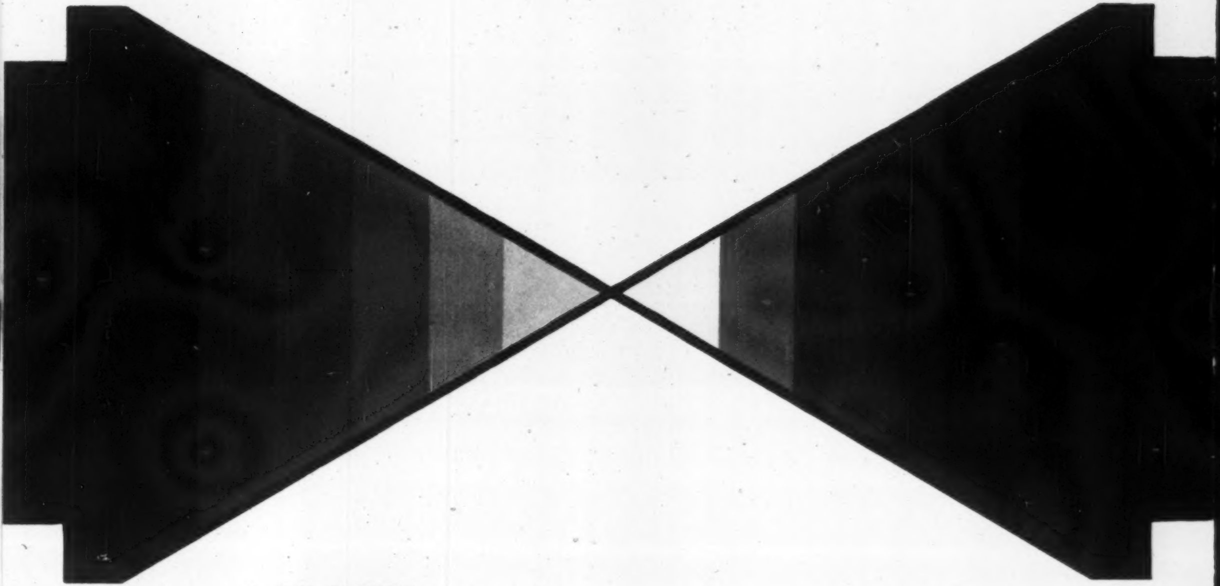
DUNHAM-BUSH

DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.

SALES OFFICES LOCATED IN PRINCIPAL CITIES

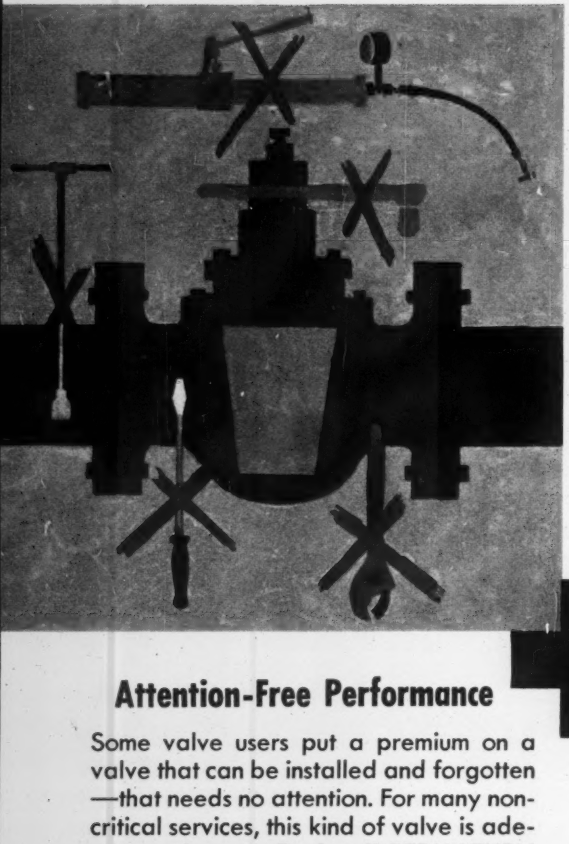
Some valves are designed
for the easy services...
the others,
for the tough ones...



NOW,
ROCKWELL HAS DEVELOPED
AN EXCITING, NEW
CONCEPT THAT
SPANS THE SPECTRUM
OF VALVE SERVICES

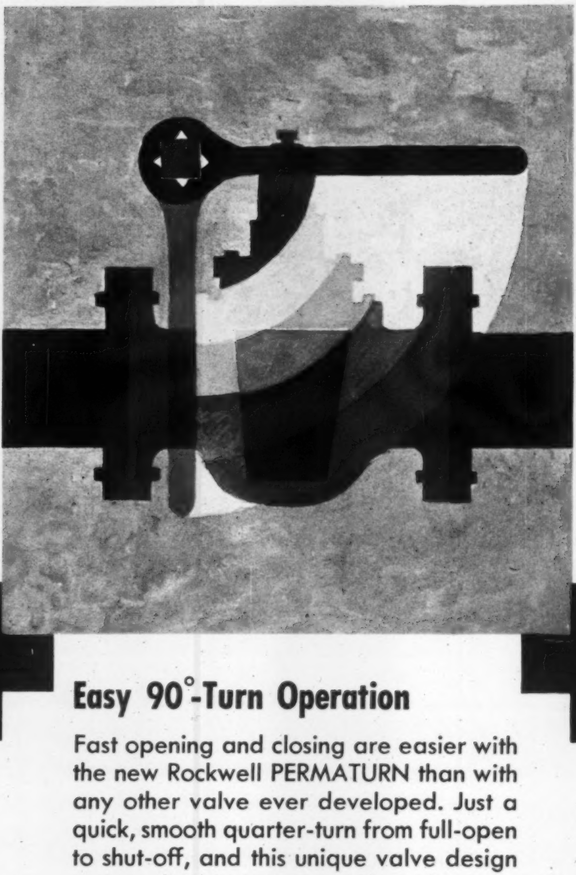
THE NEW ROCKWELL PER

Now, in one va
for versatile ap



Attention-Free Performance

Some valve users put a premium on a valve that can be installed and forgotten—that needs no attention. For many non-critical services, this kind of valve is adequate: the new Rockwell PERMATURN valves can be used in such services with no attention—and with excellent results.



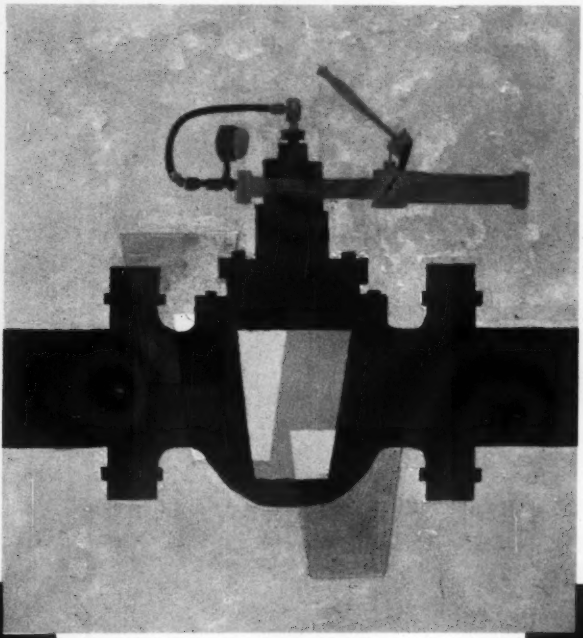
Easy 90°-Turn Operation

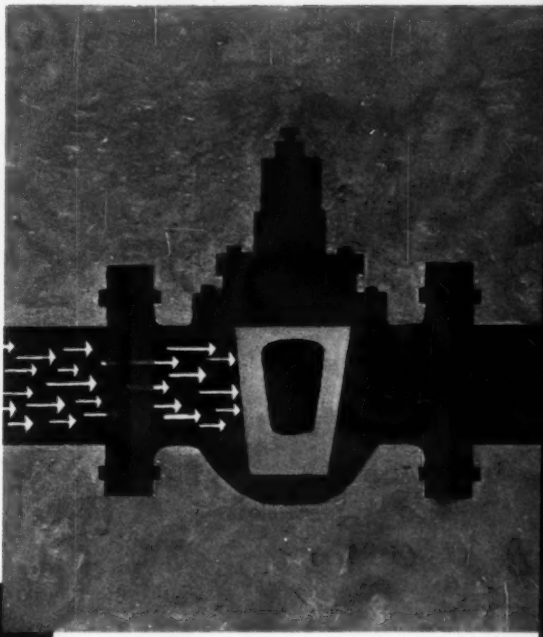
Fast opening and closing are easier with the new Rockwell PERMATURN than with any other valve ever developed. Just a quick, smooth quarter-turn from full-open to shut-off, and this unique valve design assures low-torque operation always—that's where the name PERMATURN comes from!

LIFT THESE PAGES for more information on this exciting new valve line!

RMATURN® VALVE DESIGN!

alve, you get all the features needed pplication to any fluid control service





Push-Button Seat Replacement

Here's a feature you'll find in no other type valve: you can put a new seating surface in the new PERMATURN valve in seconds, *without loosening a single bolt*. You can replace valve seats as often as you like—no more putting up with leaky valves. You add years of life—and save money—with this performance-extending feature of PERMATURN valves.

Drop-Tight Sealing

There are some valve applications where there's just no substitute for the bottle-tight, wear-defying characteristics of the new Rockwell PERMATURN valve used with a *regular program of sealant replacement*. And in these critical services, the PERMATURN valve has dramatically reduced operating torque requirements.

ne!

THE NEW ROCKWELL P

available in all sizes f

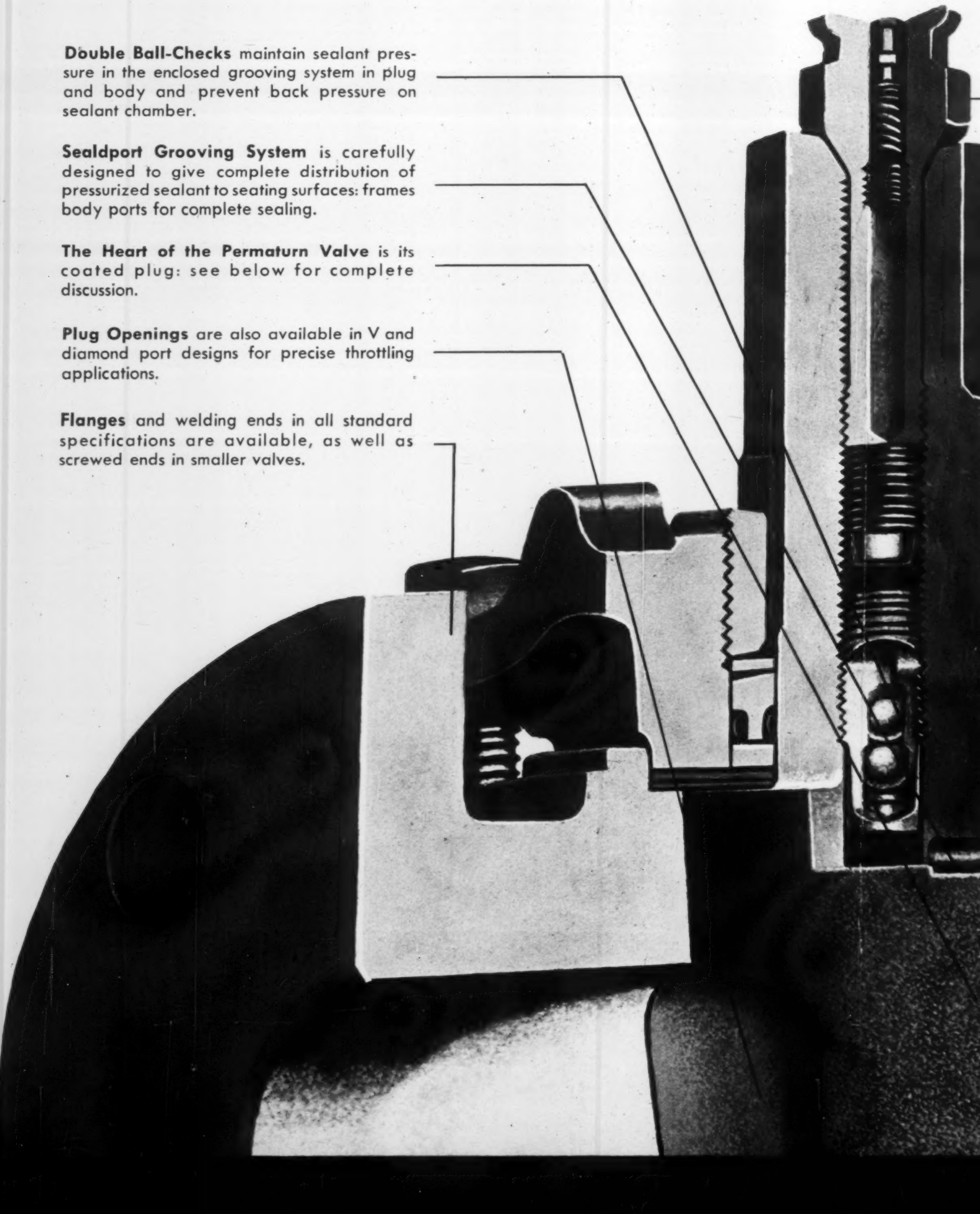
Double Ball-Checks maintain sealant pressure in the enclosed grooving system in plug and body and prevent back pressure on sealant chamber.

Sealdport Grooving System is carefully designed to give complete distribution of pressurized sealant to seating surfaces: frames body ports for complete sealing.

The Heart of the Permaturn Valve is its coated plug: see below for complete discussion.

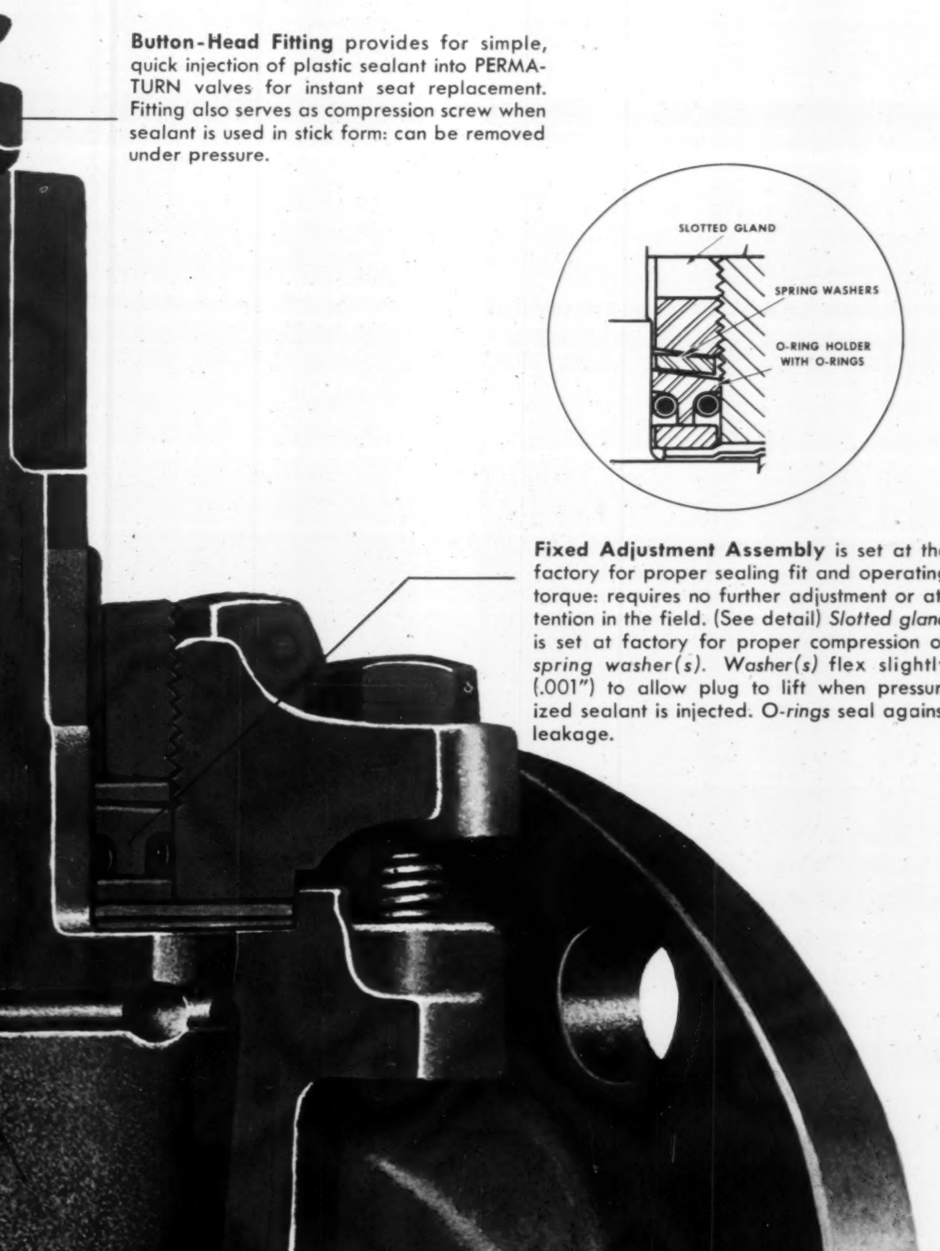
Plug Openings are also available in V and diamond port designs for precise throttling applications.

Flanges and welding ends in all standard specifications are available, as well as screwed ends in smaller valves.

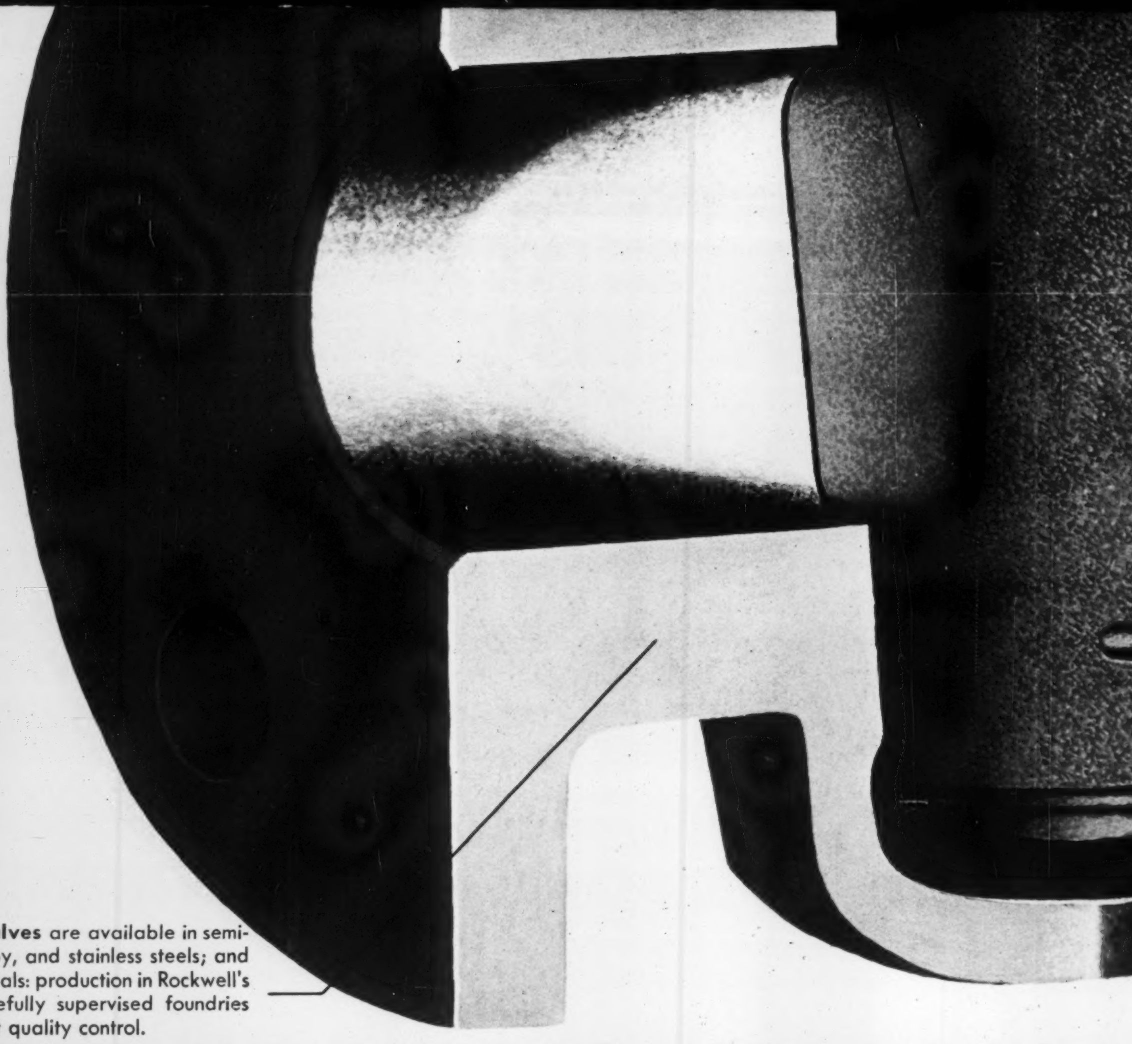


PERMATURN® VALVES for all pressures

Button-Head Fitting provides for simple, quick injection of plastic sealant into PERMATURN valves for instant seat replacement. Fitting also serves as compression screw when sealant is used in stick form: can be removed under pressure.



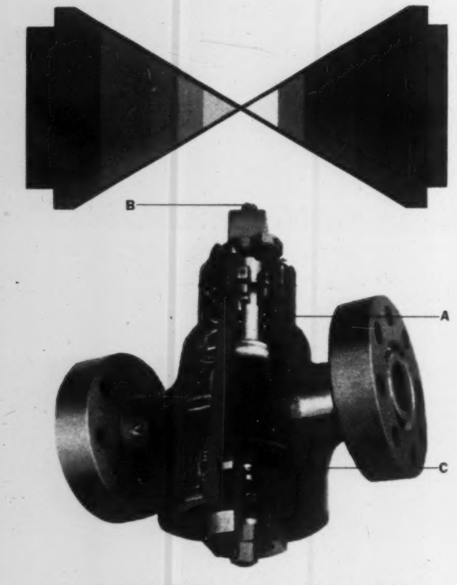
Fixed Adjustment Assembly is set at the factory for proper sealing fit and operating torque: requires no further adjustment or attention in the field. (See detail) *Slotted gland* is set at factory for proper compression of *spring washer(s)*. *Washer(s)* flex slightly (.001") to allow plug to lift when pressurized sealant is injected. *O-rings* seal against leakage.



PERMATURN Valves are available in semi-steel; carbon, alloy, and stainless steels; and non-ferrous materials: production in Rockwell's own modern, carefully supervised foundries provides excellent quality control.

The secret of the Ro

PERMATURN® valve's ve



Rockwell PERMATURN valves are also available in the inverted plug Hypreseal® design for high pressures. Low torque operation is assured by plug coating of high lubricity and bearing-guided stem. Other features are plastic stem sealing (A), fitting for "push-button" seat replacement (B), and thrust assembly (C) for controlled plug adjustment.

The unique design feature that makes the Rockwell PERMATURN valve line applicable to all valve services is its coated plug.

Developed after five years of extensive testing, the coating has an extremely low coefficient of friction and is applied in such a way that it is *permanently bonded to the metal surface of the plug.* This tenacious lubricating film gives *permanent separation of metal surfaces* of plug and body: the valves literally cannot stick or freeze.

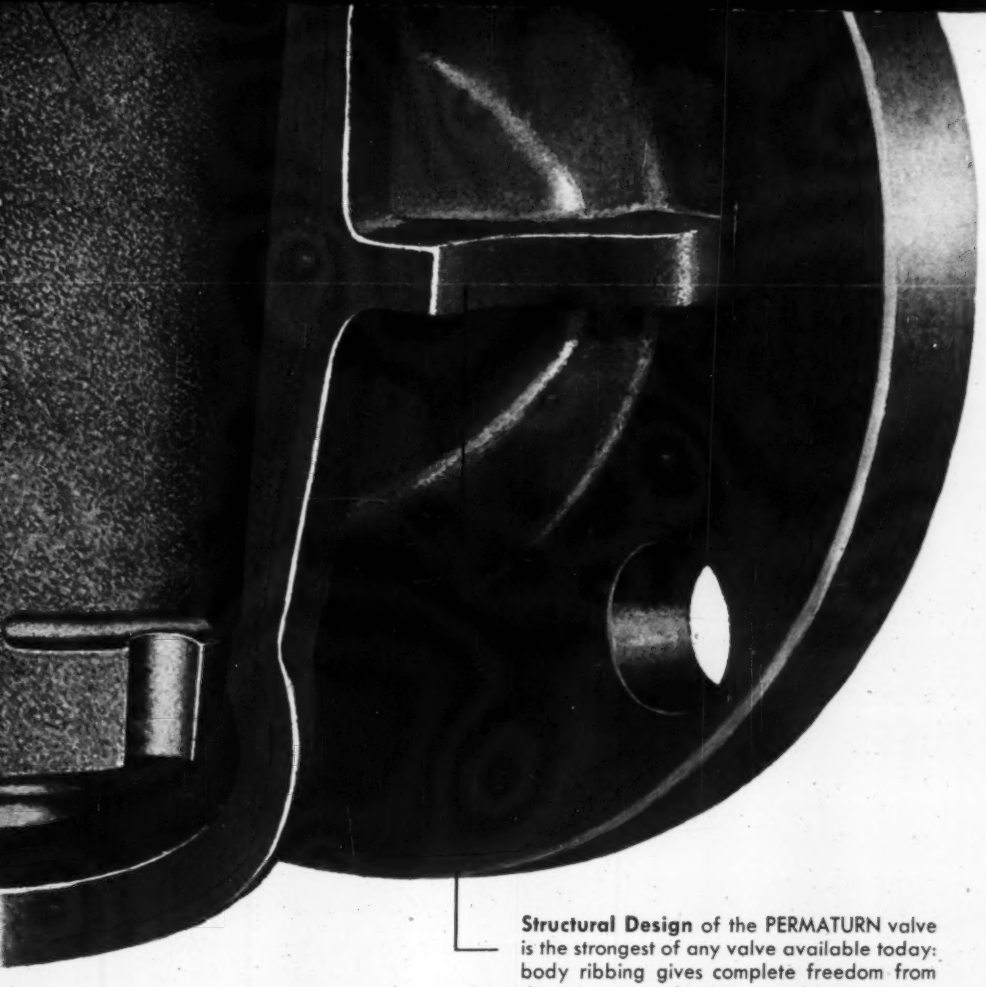
The inert nature of the plug coating assures permanent lubricity for easy, sure operation of the PERMATURN valve at all times. Combined with the many other new design features described above, the plug coating
valve these vers

Attention-Fre
fluids handled c

Easy, 90°-Turr
even where rem
tion are involved

"Push-Button"
usefulness withou

Drop-Tight Sec
this feature is a



Structural Design of the PERMATURN valve is the strongest of any valve available today: body ribbing gives complete freedom from distortion at rated pressures and temperatures.

ockwell
ersatility...

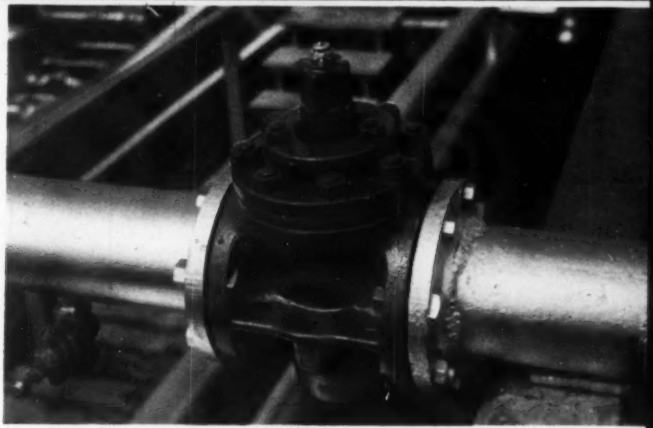
ings give the Rockwell PERMATURN
ersatile application benefits:

ree Performance in services where
d do not require a special valve.

urn Operation in all valve services,
emote operation or infrequent atten-
ved.

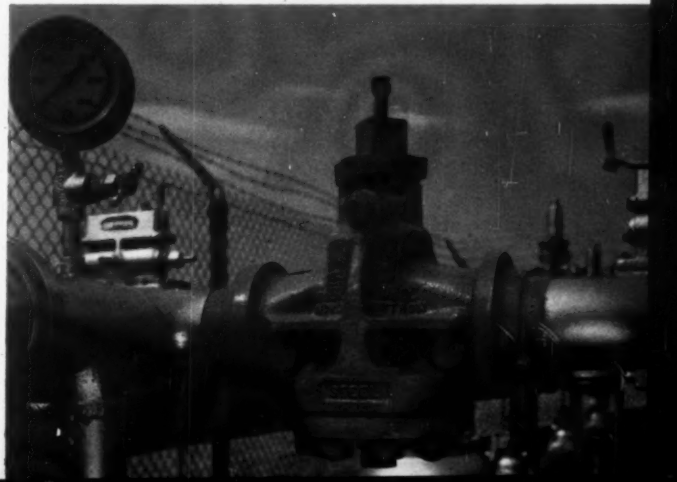
n" Seat Replacement extending valve
hout costly downtime and maintenance.

Sealing for critical applications where
s all-important.

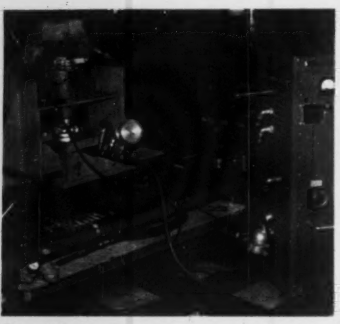


Rockwell semi-steel PERMATURN valves are shipped with a distinctive red primer paint that has wide compatibility.

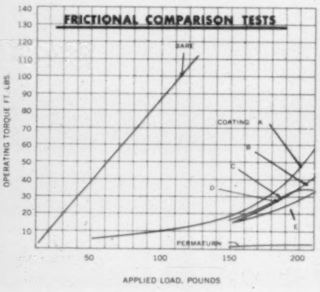
Steel PERMATURN valves are given a gray prime coat: both colors give good corrosion-protection in storage and in service.



Only Rockwell, world leader in valve research, could have developed the PERMATURN® valve



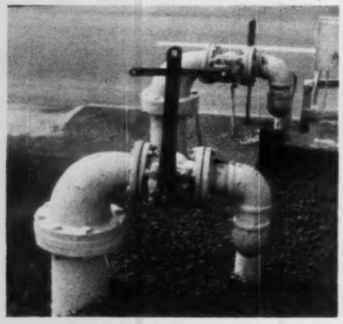
For more than forty years, Rockwell has pioneered in valve research. This background of experience, which made the Rockwell-Nordstrom lubricated plug valve the world's standard of quality, led to the five year development program on the PERMATURN valve, a new concept in versatile, all-purpose valve design.



Part of this study concerned the various characteristics of many compounds considered for the plug coating medium. Exhaustive mechanical and chemical resistance tests, and carefully measured frictional comparisons, led to the selection of a material which has proved its ability to stand up under tough service for years of normal valve operation.

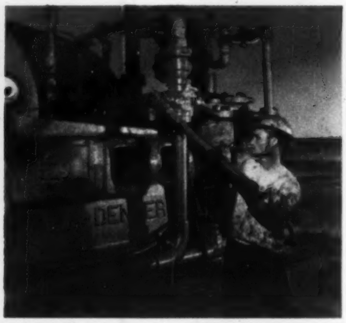
Complete production facilities for the new PERMATURN valve have been installed at Rockwell's nationwide valve manufacturing plants. The equipment shown above was specially developed to coat the plugs of Rockwell PERMATURN valves on a production line basis and is typical of installations at other Rockwell plants.

Rockwell PERMATURN® valves have been customer-proved before introduction



NO ATTENTION has been given these Rockwell PERMATURN valves on hydrocarbon service in the year and a half since their installation. Operation is positive and easy—and shut-off is still as bottle-tight as the day the valves were installed.

JET FUEL is handled by these Rockwell PERMATURN valves, in service since 1960. Operators have found the plug coating of PERMATURN valves gives smooth, easy operation—and has reduced sealant injection needs from once-a-week to once every three months.



SURE OPERATION on tough services has been proved by pilot installations of PERMATURN valves across the country. The coated plug supplements a regular program of sealant replacement, needed in these services for long valve life, to assure low-torque operation at all times.

Rockwell Manufacturing Company
Pittsburgh 8, Pennsylvania

I'd like to have your "Pocket Valve Guide" with brief specs and coverage charts on Rockwell PERMATURN valves.

Name __________ Title __________

Firm __________

Address __________

City __________ Zone _____ State __________

ROCKWELL PERMATURN VALVES
another fine product by
ROCKWELL

you'll want to know . . .

County Officials Adopt Anti-Air Pollution Policies

A NEW SET of anti-air pollution policies has been adopted by the 2000 delegates who attended the annual conference of the National Association of County Officials held recently in Chicago, Ill. The policies were made a part of the American County Platform.

Recommended were: Federal legislation to strengthen and expand the existing research and assistance program; rapid tax write-off of air pollution control equipment; installation of blowby controls as standard equipment on all autos manufactured for sale in the U.S.; and the calling of a White House Conference on air pollution in 1962.

Also issued was a statement emphasizing the need for legislation by states to enable counties to administer air pollution control programs, according to the Los Angeles County Air Pollution Control District.

The new policies were drafted by the Air Pollution Committee headed by County Supervisor William Phillips of Orange County, Calif., and were based, in part, on recommendations developed by the Southern California Air Pollution Coordinating Council.

Following is the platform on air pollution adopted at the meeting:

10-1. *Basic Responsibility for Control in Local Governments.* The basic responsibility for formulating and carrying out air pollution abatement programs rests with the local governments. The abatement authority should be extended to state, interstate, or Federal jurisdiction, as appropriate, when the problem extends beyond local boundaries.

10-2. *County or Multi-County Control.* NACO recognizes the need for air pollution control on a county or multi-county basis without regard to city boundaries. The laws of many states do not now permit the county or multi-county approach to the abatement of air pollution, a problem which does not respect political boundaries. NACO therefore urges state legislation that will enable individual counties or groups of counties to control their air pollution problems within one state or on an interstate basis in accordance with their needs.

10-3. *National Problem: Federal Role in Research.* Fresh, clean air is an American natural resource and it must be conserved and protected. Air pollution is a national problem both in urban areas and in agricultural areas. The economic damage from air pollution, its threat of health impairment of our population, the rapid growth of the population and of the national economy with the attendant increases in the quantities of air pollution from all sources, all indicate the need for intensified action at national, state, and local levels.

On the federal level, NACO recommends the broadening and strengthening of the existing air

you'll want to know

pollution program to provide:

(a) Establishment of a permanent federal air pollution research and assistance program, without legislative limitations on annual appropriations or program duration.

(b) Expansion of the federal research program related to the causes, effects and control of air pollution.

(c) Federal technical and financial assistance to states and localities in the development and administration of regulatory control of air pollution. Such federal assistance is urgently needed to stimulate and aid in the conduct of more effective regulatory programs for air pollution control.

(d) More vigorous leadership to secure needed attention, study, and correction of air pollution problems by all levels of government, by industry, and by the general public.

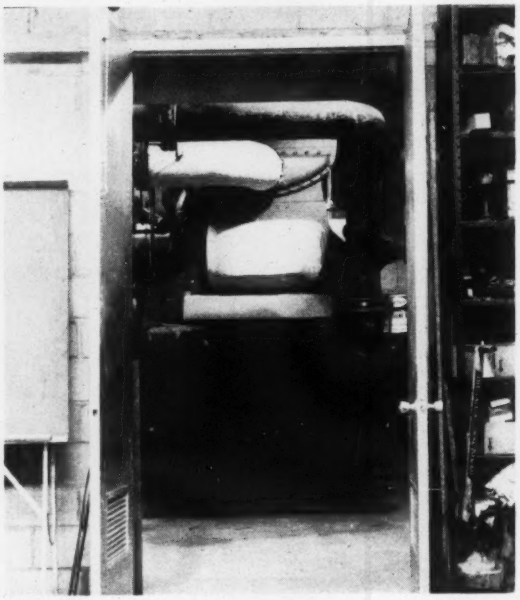
(e) Guidance to all federal agencies by definition of policies and standards to be observed in the construction and operation of facilities and equipment, operated or controlled by federal jurisdictions, to the end that exemplary air pollution control practices are followed.

10-4. *Intergovernmental Cooperation.* NACO believes that the solution of the national air pollution control problem will depend on, and we encourage, effective intergovernmental relationships between the agencies of the federal, state and local governments, and will require the coordination of research, developmental and control activities being conducted by private research or academic institutions.

10-5. *Second National Air Pollution Conference.* NACO lauds the program and recommendations of the National Conference on Air Pollution of 1958 and urges that a second conference be held in 1961 or at as early a date as is practicable in order to evaluate progress in air pollution control programs, nationally, since the first conference.

10-6. *Motor Vehicle Contamination.* Pollution emissions from motor vehicles have become a significant national problem. NACO recognizes that responsibility for solving this problem is a burden of the vehicle manufacturer. Since inexpensive devices now are available to halt contaminant losses from vehicle crankcases, the National Association of County Officials urges the automobile industry to install such devices, as standard equipment, on all new vehicles manufactured for sale in the United States.

10-7. *Tax Encouragement.* NACO urges Congress to recognize the benefits resulting to public health and welfare from costly and nonproductive industrial air pollution treatment works by permitting such works to be amortized at an accelerated rate for income tax purposes. Furthermore, we urge that state and counties take appropriate action to allow them to exclude such air pollution treatment works from being considered when assessing industrial plants for tax purposes.



COOLING for the Newberry warehouse originates with this 407 ton automatic absorption refrigerating machine which chills water for the system

Added Cooling Scores Big Success at N.Y. Warehouse

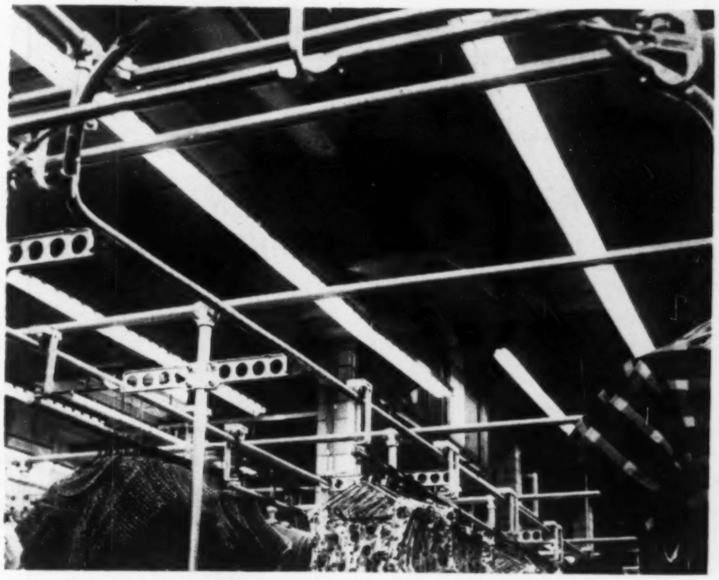
AIR CONDITIONING figures prominently in the operation of the huge new J. J. Newberry Co. warehouse in Woodside, N.Y. The two-story, 290,000 sq ft building houses $3 million worth of goods ranging from needles to furniture, and serves 350 Newberry stores east of the Rocky Mountains.

A style warehouse operation, including ladies' dresses, robes, blouses, skirts, and coats, was a large factor in the decision to air condition the warehouse. The garments are hung without covering on racks, just as they come from the factory. Without air conditioning, the light-colored fabrics could be soiled by perspiring employees or dust.

The $2 million structure was originally designed for heating and ventilation. Cooling was added, at a cost of 10 cents per sq ft amortized over 10 years, when it was realized that no amount of ventilation could keep the 200 employees comfortable in summer. The center of the building is a full city block from any window.

Interior conditions are maintained at about 80 F and 50 percent relative humidity. An absorption refrigerating machine with a 407 ton cooling capacity supplies chilled water to 19 fan-coil units suspended from 22 ft ceilings, according to Carrier Corp.

The system was designed by Sears and Kopf, consulting engineers.



CHILLED WATER passes through this strategically placed ceiling hung fan-coil unit, one of 19 used in the Newberry Co. warehouse

EVEN light-colored or white garments can hang without protection—and in this case, almost directly under the duct outlet above in the Newberry Co. warehouse

Install Air Cooled Condensers in Government Buildings

OFFICES of the Federal Aviation Agency, the Navy, and the Central Intelligence Agency in Washington, D.C. will be cool next summer due to the installation of air cooled condensers and packaged air conditioning units.

Thirty-two condensers of 15 ton capacity each have already been installed, these in buildings T-4 and T-5 of the General Service Administration. An additional six 5 ton units will be installed at a later date. Some 2000 people work in these buildings, according to Halstead & Mitchell Co.

The packaged air conditioning units which are serviced by the condensers operate almost constantly because of the high Washington temperatures. Each unit serves from five to seven rooms. Because the heat load is so constant, it is a rare occasion during the summer when the thermostats take over the control of the units.

These thermostats are located in the return air stream of each unit, and activate expansion valves serving the units.

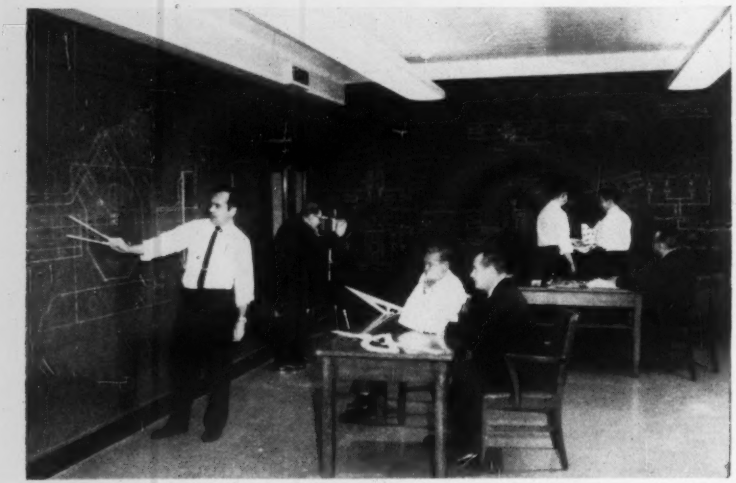
you'll want to know

New Engineering Design Method Promises To Cut Drafting Costs

ENGINEERING, design, and drafting costs can be cut from 33 to 50 percent by adopting a new engineering method, according to T A B Engineers, Inc., Chicago, Ill. Called the "Panoramic Design Technique," the method does away with drawings made by using conventional drawing boards, parallels, and T-squares.

Instead, engineers using the new method would put their designs directly on wall-size blackboards and record them photographically, according to C. E. Evanson, the firm's president.

The method works this way. Engineers and designers work together as a group at a huge blackboard. Each man is assigned a specific area or part of the design to develop, and his ideas are on display as he progresses.



DRAWING BOARDS are conspicuously missing in this engineering drafting room at T A B Engineers, Inc., where the "Panoramic Design Technique" is shown in action

This enables supervisory personnel to see the project in its entirety instead of inspecting individual drawings one at a time. If a change is indicated, it can be made just by erasing the chalk and sketching a new version.

The men do calculations and other preparatory work right at the blackboard site.

When a satisfactory design is developed, a detailed drawing can be made immediately by the use of a plastic overlay which is already ruled, and on which the engineer can sketch the other views and add dimensions. Instead of transferring this work to a drawing board, photographs are taken of the design.

These photographs, which are pocket-size prints, are used instead of blue-print enlargements. T A B has discovered that these are sufficient, and are in fact superior in that they eliminate the need to handle large blueprints on the construction site.

The originator of the method, H. A. Edmonds, is T A B's vice president and director of engineering. He claims "the change in the engineers' efficiency is revolutionary. By seeing how his portion of the design fits the whole pattern, the engineer is stimulated to do better work. And he can frequently help his fellow engineers on the board by suggesting improvements for their phase of the project."

Another feature of the new method is that it requires only six tools: a triangle, rule, protractor, compass, chalk, and eraser.

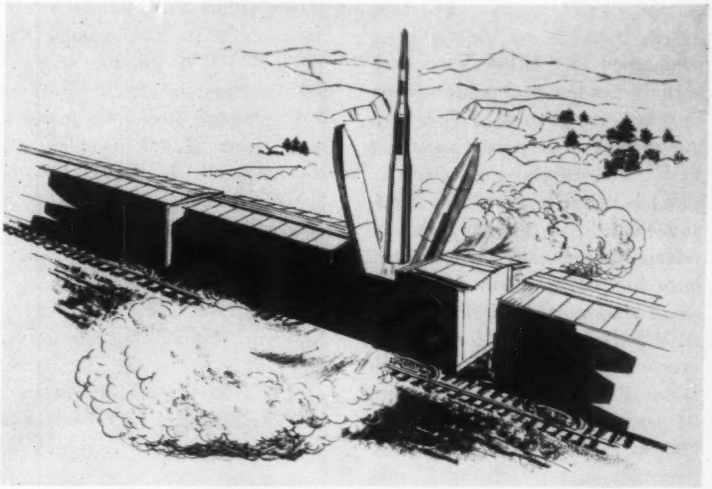
Metal Tags No Longer Accepted on Imported Welded Fittings, Flanges

MARKING of imported forged steel welding fittings and flanges with metal tags to show country of origin is no longer acceptable, according to a new decision of the U.S. Bureau of Customs, as reported by the American Forged Fitting & Flange Association.

In announcing the new position, Philip Nicholson, Commissioner of Customs, stated that "it has been found that the marked tags that are welded to the welding fittings and welding flanges are not remaining on the articles until they reach the ultimate purchaser."

The ruling provides that as of October 17, 1961, marking of country of origin must be by raised lettering or diesinking for these items.

Mobile Missile Trains Require Air Conditioning for Computing Equipment



ICBM launched from train cars is another of potential weapons of the U. S. that demands constant temperature control for computing equipment

PART of the responsibility of defending the nation was again placed on air conditioning when the Strategic Air Command conducted tests to show how well a future fleet of actual missile trains could operate over existing tracks. Missiles require complicated computing equipment; and computing equipment requires cooling in order to operate with accuracy.

SAC, cooperating with other military agencies and major civilian rail lines, conducted these tests in the summer of 1960. Sometime in the future, SAC believes, several trains will carry new Minuteman Intercontinental Ballistic Missiles over the nation's rail network, ready to launch against foreign aggressors.

To prove the feasibility of this method, tests were conducted by Ben F. Holbrook, Ogden, Utah, engineer and contractor for the installation.

The two cars in the test train that required air conditioning were the "ready" and "nerve" cars. Because of interior space restrictions, an air cooled chiller with a low silhouette was installed under these cars.

In the "ready" car, the existing ice bunkers were removed from under the car to make room for the condensing unit. The condenser fan was changed to a horizontal discharge, with the standard top discharge hole being patched, according to the Chrysler Airtemp Div.

The condenser unit was connected to a direct expansion water chiller. Chilled water from this unit was then circulated through the existing fan-coil unit that had been used with ice water from the old ice bunkers.

In the "nerve" car of the test train, which contains the missile computing equipment, a condensing unit was installed with an air handling unit.

The equipment satisfactorily passed tests in temperatures which exceeded 105 F, according to Mr. Holbrook.

Alloys Raise Power Piping Pressure-Temperature Limits

A POTENTIAL solution to the temperature-pressure plateau presently existing in power piping design was offered recently at a conference sponsored by the International Nickel Co. in cooperation with the Denver Research Institute of the University of Denver. The solution: a new nickel-chromium based alloy, matrix strengthened with columbium, molybdenum, and tungsten.

This alloy has a rupture strength of 28,000 psi at 1200 F for 100,000 hr., estimated, and is based on tests now approaching 10,000 hr. Good structural stability is characteristic of the alloy: it retains high ductility after long exposure to temperature and stress.

The alloy is not yet commercially available, but a 5000 lb commercial heat, toll melted, has been made. From this a variety of mill forms have been produced, including tubing.

A paper on the new alloy was presented at the conference by T. E. Kilghren, of the development and research division of Inco. Present experience indicates that welding and brazing response is good, Mr. Kilghren noted, with weld joint efficiencies of 90 percent being achieved, though the fusion must be strengthened by coating the welding electrodes. No problems have been encountered in welding heavy sections; and the electrodes developed will weld in all positions.

Another topic discussed at the

you'll want to know

conference was "How extra low carbon grades of stainless steel can be strengthened." This was the subject of a paper presented by R. A. Kozlik, also of Inco.

While these grades, Type 304L and Type 316L, are attractive in certain applications, their use has been limited by a low maximum stress allowance established in the ASME boiler code for unfired pressure vessels. The stress penalty for 304L stainless steel is 19 to 24 percent at 800 F. Its use above 800 is not permitted. The stress penalty is greater for Type 316L.

One reason for these low stress allowances is the variability of high temperature properties of the alloys within AISI standard composition limits. For example, the 1200 F, 100 hr rupture stress of four commercial heats of Type 304L stainless steel were found to range from 21,000 to 33,000 psi. However, it is now known that the lower end of this range can be increased to 33,000 psi by suitable control of the chemical composition, according to Mr. Kozlik.

In addition, columbium, boron, titanium, vanadium, aluminum, and copper, when used as alloying elements, have a decided strengthening effect on the low carbon stainless steels. By controlling the level of residual elements, the 1200 F rupture strength of Type 304L can be raised above that of Type 347, Mr. Kozlik continued. In fact, a composition range with relatively wide limits was developed that consistently produced minimum 100 hr rupture stresses of 30,000 psi at 1200 F.

The basis for comparison of the strengthening effects of the alloying elements studied in the research reported is the stress required to cause rupture of hot rolled 18-8 stainless steel at 1200 F for 100 hr. The steel was annealed at 1950 F before the test. Other criteria are also important for comparative purposes, but for simplicity, the 100 hr rupture stress was selected for this work.

Shopping Center Can Operate Cooling at 5 Percent Capacity

To achieve a maximum of fuel economy, cooling is supplied to the new Walnut Hill Plaza Shopping Center only in the amount that is needed. The compressors can unload down to 25 percent of capacity, and then through modulation, the output is reduced to 5 percent of maximum cooling effect.

Located in Woonsocket, R.I., the shopping center is composed of four large stores and 26 smaller units. Total area is 120,000 sq ft, with the large stores comprising 85,000 sq ft. Of this area, 52,600 sq ft are air conditioned.

Four-cylinder compressors, belt-driven by heavy-duty sleeve type natural gas engines, cool each of the four large stores. Belt drive was chosen to avoid harmonious frequencies between compressor and engine. Rated at 80 hp, the engines operate at a governed speed of 1800 rpm. With 1040 Btu per hr gas, they deliver 60 hp.

In two of the stores the engines run all day, idling when the compressor is not working. The other two stores have their engines set up for fully automatic on-and-off operation. After one year of operation, there are indications that the on-and-off operation is more economical, according to the American Gas Association. However further studies will be made in the future to verify this.

Two-stage thermostats, working in conjunction with a two-stage cooling coil system, control the operation of the engine-compressor units.

Conventional duct systems supply the air distribution. Duct heat-

STO
LIQUORS
79

NATURAL GAS ENGINES drive four-cylinder compressors to cool four of the larger stores in Walnut Hill Plaza Shopping Center.

Roof-Mounted Units Cool and Heat New Shopping Center

THE NEW Grand-Way Shopping Center in Central Plaza, N.Y., is completely cooled and heated for year around comfort. Roof-mounted cooling and heating units supply conditioned air directly to the conditioned areas.

The center is composed of eight stores with a total of 100,000 sq ft of space, all of which is departmentalized within given floor areas. Each store is independent and separately air conditioned.

Two short sections of molded glass fiber vertical duct connect each unit to an air diffuser mounted in the store ceiling. Individual units are placed over areas where the greatest demand of conditioning is required.

Temperature is controlled by individual thermostats, allowing zone control, according to Melchior, Armstrong, Dessau Inc. But if one unit should require maintenance, other units can carry the additional load.

There are nine combination heating cooling units in a supermarket building area. From one to four units are used in the remaining seven stores.

ers are installed upstream from the cooling coils to avoid condensation. There are four heaters in one store and three each in the other three stores. All of these units are rated at 250,000 Btu per hr. In addition, a garage area for one store has four 65,000 Btu per hr heaters and a larger unit in the loading platform area.

Airtite Engineering Co., Pawtucket, R.I., was the mechanical engineer and contractor for the project.

College Conducts Animal-Human Study To Test Air Pollution Effects

MORE THAN 4000 experimental animals—rats, guinea pigs, rabbits, and mice—will be used to test the possible effects of air pollution on human health at the Wayne State University College of Medicine in Detroit, Mich. And in conjunction with the animal study, human subjects will be exposed to many of the animal experimental conditions to achieve further knowledge on this growing problem.

The program is being financed through a $190,000 Public Health Service contract, according to Luther L. Terry, Surgeon General of the U.S. Public Health Service. Particular emphasis will be placed on the animals' pulmonary function, length of life, blood studies, and pulmonary pathology.

The animals will be divided into three groups. The first will breathe exhaust-contaminated air pulled in directly from a heavily traveled street through a large duct especially constructed for the study. The second group will be exposed to the normal urban air present in the laboratory. The third group will be housed in a room containing specially cleaned air, from which almost all impurities will have been removed.

Among the common air pollutants which will be measured continuously, using automatic electronic instruments, are carbon monoxide, total hydrocarbons, oxides of nitrogen, total oxidants, sulfur dioxide, carbon dioxide, and inorganic particulates.

Many of the animals will be kept under study during their entire lifetime; others will be sacrificed to permit studies of tissue structure in lungs and other vital organs.

Dr. Arthur J. Vorwald, professor and chairman of the Department of Industrial Medicine and Hygiene at Wayne State, will conduct the study.

New ASHRAE Chicago Chapter Plans Refrigeration Meetings

A NEW "Chicago Chapter" of the American Society of Heating, Refrigerating and Air-Conditioning Engineers was formed at a meeting attended by 106 society members and guests held October 12 at the Germania Club. Thus, there will be two separate ASHRAE

you'll want to know

chapters in Chicago, the Illinois chapter and the new group.

The Chicago chapter has scheduled regular meetings to be held the second Thursday of each month at the Builders club. The meetings will be devoted to refrigeration subjects. This is the same meeting night and place as for the old Chicago section of the American Society of Refrigerating Engineers before its merger with the American Society of Heating and Air-Conditioning Engineers.

The ASHRAE Illinois chapter meets the second Monday of the month at the Merchants and Manufacturers club, as did ASHAE's Illinois chapter prior to the merger.

The membership roster of the new Chicago chapter had 160 names as of the early part of last month. Charles C. Hansen III is president of the group.

AGA Enters Program To Develop Gas Heat Electric Generator

Direct conversion of gas heat into electricity is moving a step closer to practical use in a research program undertaken jointly by the American Gas Association and General Dynamics Corp.'s General Atomic Div.

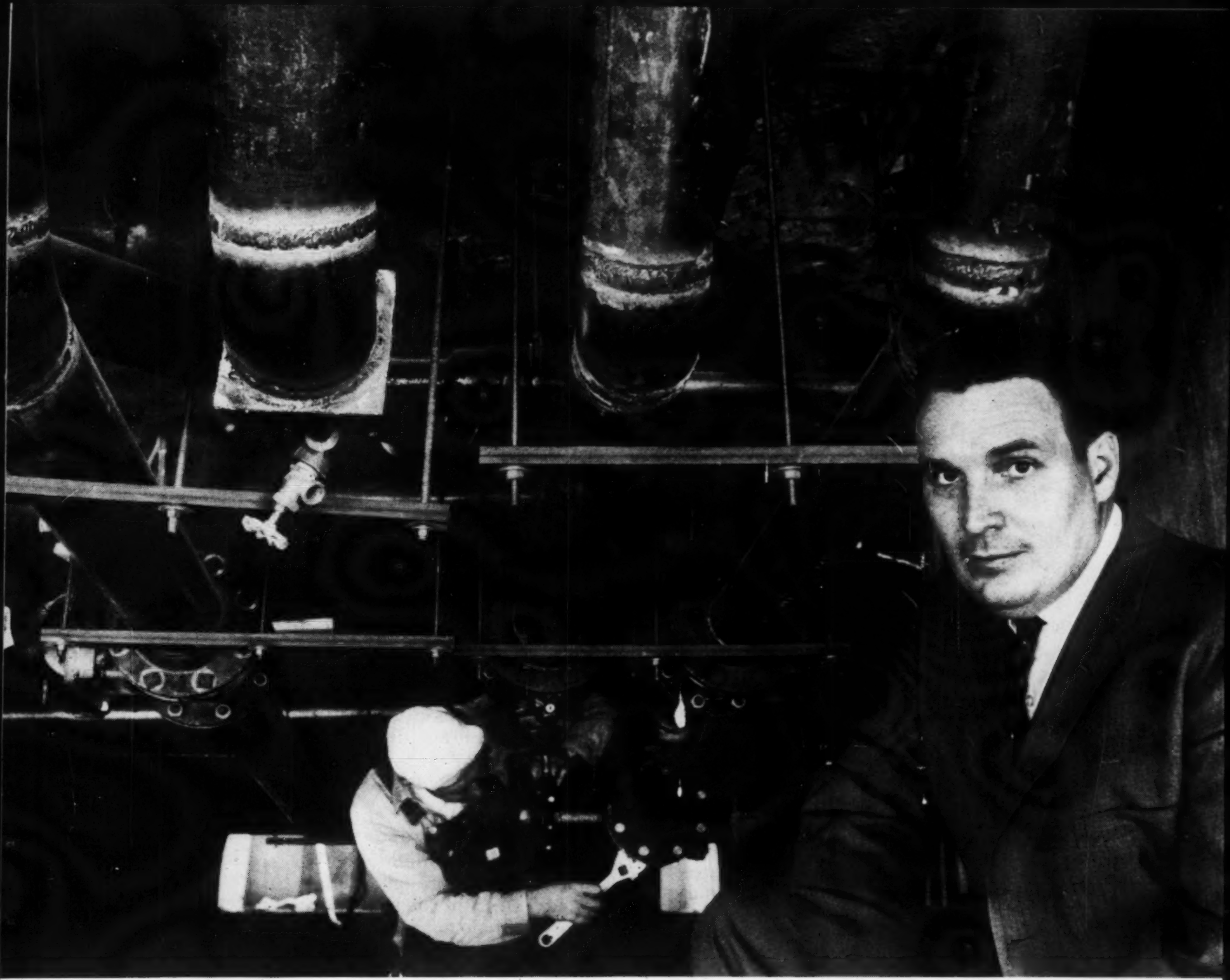
The aim of the project is to develop a small, low-cost thermoelectric module which can be used to convert part of the heat from a gas flame directly into small amounts of auxiliary electric power. Such power could be used to supply energy necessary to operate a blower on a gas furnace. It might also be used to operate controls, fans, pumps, and blowers on other gas appliances.

Engineers Adopt "New Chicago Plan for Separate Bids"

. . . see article on page 139

JOINT INDUSTRY COMMITTEE members present at August 11, 1961 meeting at which "The new Chicago Plan for Separate Bids" was adopted: *Seated, l to r,* W. J. Buchman, Immediate Past President, Chicago Chapter American Institute of Architects, Bachman and Bertram; W. A. Kuechenberg, Chairman, Coordinating Committee of Mechanical Specialty Contractors Associations of Chicago, R. B. Hayward Co.; R. Rea Esgar, President, Chicago Chapter American Institute of Architects, R. Rea Esgar Co.; E. H. Marhoefer, Jr., Builders Association of Chicago, E. H. Marhoefer Co., General Contractors; R. J. Houkal, Jr., President, Chicago Association of Consulting Engineers, Perkins & Will, Architects.

Standing, l to r, H. Sobel, Herbert H. Sobel Co., Architects-Engineers; T. R. Friedman, Friedman, Alschuler and Sincere, Architects; D. Fetters, Gerhardt F. Meyne Co., General Contractors; L. J. Keefe, President, Plumbing Contractors Association of Chicago, L. J. Keefe Co.; John Dolio, John Dolio and Associates, Consulting Engineers; J. H. McCauley, Jr., Immediate Past President, Mechanical Contractors Chicago Association, James H. McCauley & Sons; C. Kuglin, Childs & Smith, Architects-Engineers; E. H. Matthei, Perkins & Will, Architects; W. J. O'Brien, President, Electrical Contractors Association of City of Chicago, W. J. O'Brien Electric Co., Inc.; Henry J. Couch, Executive Secretary, Coordinating Committee of Mechanical Specialty Contractors Associations of Chicago, and R. G. Burkhardt, R. G. Burkhardt & Associates, Engineers



Spang Steel Pipe serves the combination heating and cooling system at the deluxe 888 Logan Apartments, Denver, Colorado

SPANG CW STEEL PIPE

"We've been users of SPANG Steel Pipe for 15 years"

—says Mr. Arthur Riley, President, Riley Engineering Corporation, Denver, Colorado

"...and we know SPANG more than amply meets our rigid requirements!"

That's what Mr. Riley told us at the 12-story 888 Logan Apartment Building job site, where he was supervising the installation of over two miles of SPANG Steel Pipe in the combination hot water heating and chilled water cooling system.

"Frankly," says Mr. Riley, "we depend on the quality control exercised in the manufacturing processes of SPANG. Our reputation is at stake on every job, and we depend heavily on the materials used in a project. We know SPANG is among the best pipe available."

In reply to our question about SPANG Pipe's outstanding features, Mr. Riley stated, "SPANG is easy to work with, it has good welding characteristics, its quality is consistent, it's durable, and we get good service."

Get all these advantages from SPANG Steel Pipe on *your* next job. You can't buy a better pipe! Let your local SPANG Distributor serve you soon.

SPANG Steel Pipe is one of the many fine products made by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.*

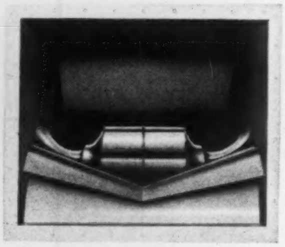
Steel — Steel's Symbol of strength, long life, and economy

Architects:
W. C. Muchow and Nat S. Sachter, Denver
Consulting Engineer:
Riley Engineering Corporation, Denver
Builder: Al Cohen, Denver
Plumbing Contractor:
John F. McCauley, Denver
Heating and Air Conditioning Contractor:
Louis Cook, Denver
Spang Distributor:
Great Western Pipe Company, Denver

ARMCO National Supply Division

A REPORT FROM TRANE:

AN ADVANCED NEW LINE OF AIRFOIL FANS

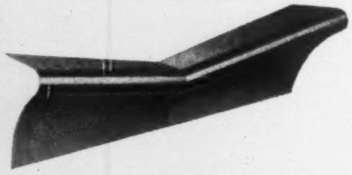


TRANE announces a completely new line of Airfoil Fans. It is a new and advanced line—that provides quiet operation, high efficiency and uniform air delivery.

There's a **TRANE** Airfoil Fan for virtually every application—for comfort heating, ventilating or air conditioning—for higher pressures of Class III applications—for high or low pressure industrial process systems. This new line is available in a complete size range of Class I, Class II and Class III—Class I and II from 24″ to 89″; Class III from 24″ to 73″. Units have 88 to 91 per cent total efficiency rating.

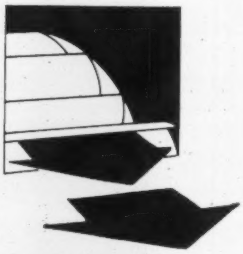
Extensive research was done on every component of the new **TRANE** Fan. Countless tests were run. New manufacturing processes were developed to duplicate the exact contours of precision-built test models. Result: A fan that brings improved performance to air moving equipment.

EXCLUSIVE AIR CUTOFF



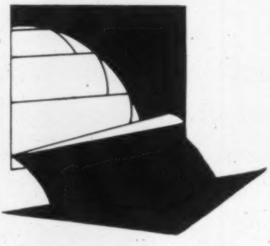
In developing this new line of Airfoil Fans, a design feature of major importance is the new type of air cutoff. The sloping rolled design of this cutoff helps create a more uniform flow of discharge air and reduces recirculation of air between the housing sides and fan wheel for quieter, more efficient fan operation.

OLD STYLE CUTOFF



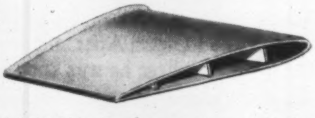
With standard cutoff parallel to fan blades, definite impact results as air leaves the full width of blade, hits the full width of cutoff. This non-uniform air discharge sets up an objectionable sound that repeats at blade frequency.

NEW TRANE CUTOFF



The sloping rolled cutoff peels the air off fan blade edges; air from the inlet end of each blade contacts highest point of the sloping cutoff. It intercepts the air along each point on the blade edge. As the last of the blade edge passes the lowest point of the cutoff, air from the inlet end of the next blade is already contacting the high point of the cutoff. The result is a continuous, smooth deflection of the air that is exceptionally quiet, with no "thumping."

ENTIRELY NEW BLADE DESIGN DEVELOPED

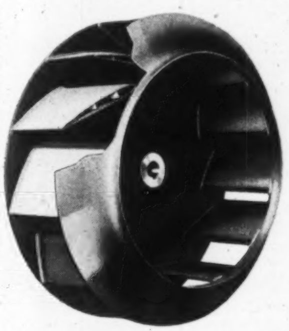


Over a hundred different types of airfoil blade shapes were developed and tested. These included blades in a wide variety of sizes and shapes—some with camber and some without.

This new **TRANE** Airfoil Blade has a very slight camber and a blade thickness that is 12 per cent of the blade's chord. This relatively thick blade contributes to the higher fan efficiency.

AIRFOIL WHEEL WITH 12 BLADES

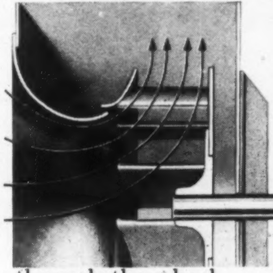
Integrated with the blade design was the development of the Airfoil Wheel and determination of the optimum number and angle of blades within the wheel. Wheels with various numbers of blades were tested. When 12 blades were used, it was found that the wheel operated most quietly and efficiently. It was also found that the sound generated by the 12-blade wheel was of a higher frequency and could be more easily attenuated.



The structural design of the wheel was proved in stress analysis tests. Wheels were run well above maximum design speeds without damage.

INLET CONE AND WHEEL RIM DESIGN ELIMINATE POWER-WASTING EDDIES

The inlet cone and wheel rim were designed and developed to work together. The design of the inlet cone permits smooth air entry with a minimum of shock and turbulence. Power-wasting eddies are eliminated.



The wheel rim reduces turbulence in the entering air as it leaves the inlet cone. By matching the contour of the inlet cone, the design of the wheel rim assures smooth, uniform air flow through the wheel.

NEW MANUFACTURING PROCESSES DEVELOPED

New manufacturing processes were developed for the TRANE Airfoil Fan to assure precise accuracy.

Each blade is manufactured from a single steel plate which is formed around a die with the trailing edge electrically welded and ground smooth. This precision die-forming and grinding results in an unusually smooth blade that is duplicated exactly and consistently time-after-time.

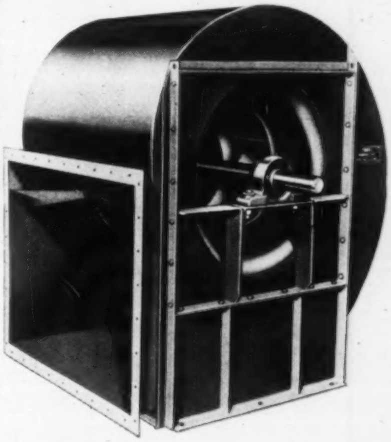
The 12 die-formed blades are continuously welded to a formed side rim and hub plate. Rigid fixtures hold components in precise position and a backstep welding procedure is used to prevent distortion and to assure close dimensional tolerances. The finished assembly is then mounted on a solid steel shaft and electronically balanced. The result is an unusually smooth-running, durable wheel.

As a result of advanced TRANE development and engineering, the new Airfoil Fans are exceptionally quiet in operation and are sturdily built to provide long life, trouble-free operation.

ACCURATELY RATED

All TRANE Airfoil Fans are accurately rated, carry the AMCA Certified Rating Seal.

WANT MORE FACTS on the new line of TRANE Airfoil Fans? Just call your nearby TRANE Sales Office—or write to TRANE, La Crosse, Wisconsin.

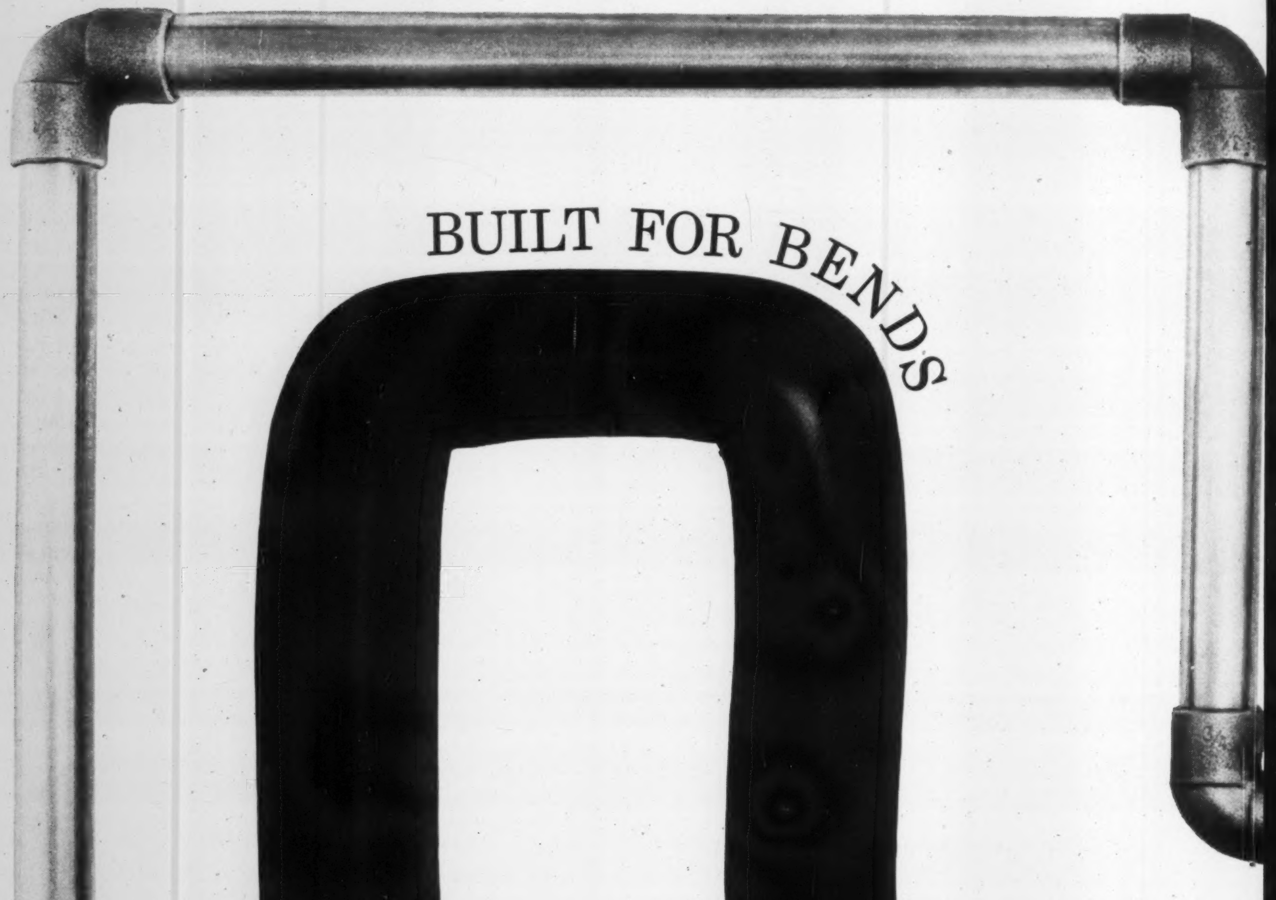


For any air condition, turn to

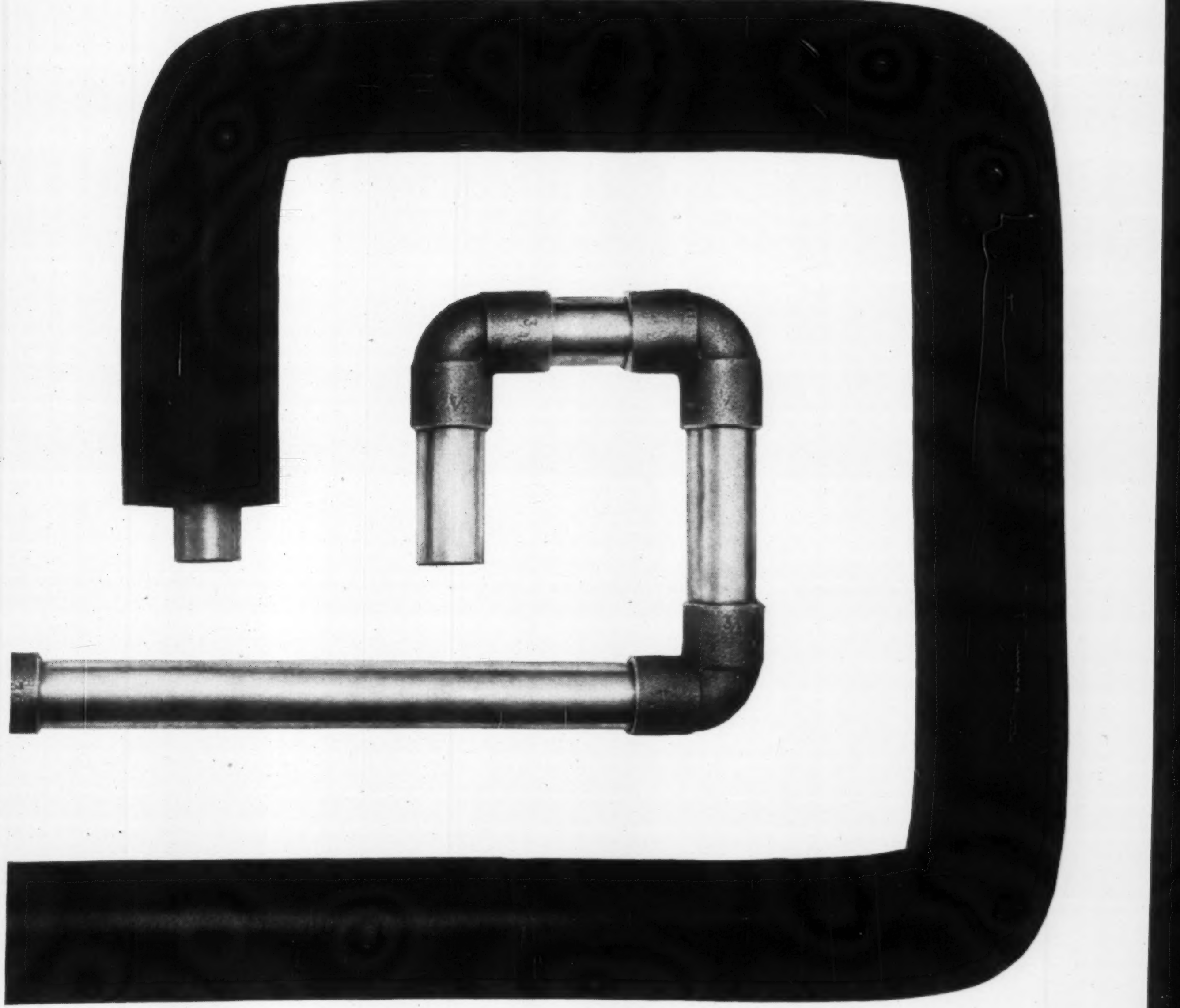
TRANE

Manufacturing engineers of air conditioning, heating, ventilating and heat transfer equipment

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. PLANT, SCRANTON, PA. • CLARKSVILLE MFG. PLANT, CLARKSVILLE, TENN. • SALT LAKE MFG. PLANT, SALT LAKE CITY, UTAH • TRANE COMPANY OF CANADA, LIMITED TORONTO • 101 U.S. AND 20 CANADIAN OFFICES



J-M Aerotube…a flexible, anti-sweat insulation designed for quick installation on bent tubing!

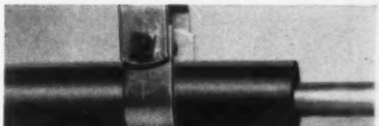


Now you can end the problem of pipe condensation on any indoor line quickly, easily and economically. With Johns-Manville Aerotube® even the most complex bend is a snap to insulate.

Aerotube is a flexible, foamed-plastic pipe insulation for use at temperatures from 32F to 220F. Its closed-cell structure prevents the passage of moisture under normal design conditions on indoor lines.

Because Aerotube is a flexible product (you can actually tie it in knots), it permits unique installation economies. The six-foot lengths go on quickly and easily. On new installations, simply slide Aerotube over tubing or pipes. For existing installations just slit Aerotube, snap it on and cement joints. That's all. Field reports show that installation costs can actually be cut in half.

If you have a condensation problem on heating, plumbing or air conditioning service lines, Aerotube can solve it. For full details, write to J. B. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N.Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.



ALSO AVAILABLE...
A RIGID AEROTUBE

For compression-free insulation at pipe supports or for underground use, J-M's rigid Aerotube is recommended.

JOHNS-MANVILLE

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE

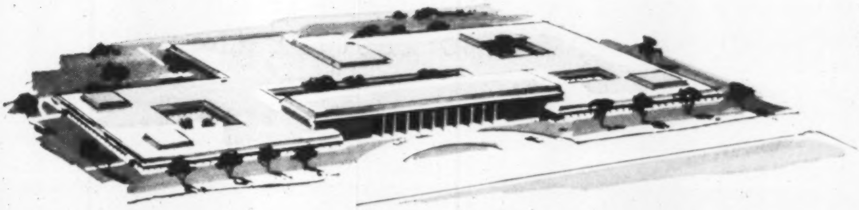
JOHNS-MANVILLE JM PRODUCTS

Edward Ross, President, Economy Plumbing Co., Mechanical Contractor for the Pure Oil Building, Palatine, Illinois, says:

"Pure Oil was an elaborate Honeywell helped

Mr. Edward Ross of Economy Plumbing. Mr. Ross found the Honeywell Selectographic Data-Center of great help in analyzing the performance of Pure Oil's temperature control systems.

job, but us over the rough spots”



ARCHITECTS: *Perkins & Will, Chicago*
CONSULTING ENGINEER: *E. R. Gritschke Assoc., Chicago*
MECHANICAL CONTRACTOR: *Economy Plumbing Co., Niles, Ill.*

At Pure Oil's new home, individual temperature control in over 400 rooms is maintained and constantly supervised by a Honeywell Selectographic DataCenter*.

"This new Pure Oil Building has one of the most intricate temperature control systems we've ever seen," says Mr. Ross. "In fact, there are more individual controls than in 99% of the systems built today." Mr. Ross adds: "We counted on Honeywell for accurate scheduling and over-all supervision of the installation—and they came through! Honeywell always had enough engineers and technicians on the job to keep everything rolling smoothly. It's very reassuring to know Honeywell's on your team."

The Honeywell Selectographic DataCenter controls temperatures for the entire Pure Oil Building. It also includes control over a building-wide security system and fire alarm system. Because the fire alarm system is hooked up to the local fire department, one of Honeywell's many jobs was to indoctrinate the Palatine Fire Department on the Selectographic and the new fire alarm system.

With 76 years experience in temperature control you can depend on Honeywell quality and service. Fine controls, accurate specifications, prompt delivery and expertly supervised installations are assured with Honeywell on your team. And only Honeywell designs and manufactures all three types of control systems—pneumatic, electric and electronic. For further information, call your nearby Honeywell Office. Or write Honeywell, Dept. AC-9-126, Minneapolis 8, Minn.

**Trademark*

Fred Heiden, Utility Operator for the Pure Oil Building, seated at the Selectographic DataCenter.

Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

"I find
copper water, heating
and drainage lines
easier and less costly
to install than
rustable materials,"

says John L. Kirsch, *President*
H. C. MAPES CORPORATION
Buffalo, N. Y.

Continued Mr. O'Connor, "The kind of homes you build is the kind of reputation you build. We have a reputation for building quality homes and we want to maintain that reputation. So, naturally, when we planned Bonwin Acres, we insisted that the plumbing and heating lines be of the best material . . . that means copper. In fact, these homes are equipped with 100% copper, from the service lines into the houses to the drainage and waste lines as well as the vent stacks. It's been our experience that with that kind of a set-up maintenance worries are over. The prospective home owner never questions the plumbing if he or she sees that copper has been used."

Now let's hear what Mr. Kirsch has to say from the plumbing contractor's point of view. "When we work with copper, we have many things to our advantage. First of all, copper water tube is easy to prefabricate in the shop or on the jobsite. It is quickly and easily soldered without worry about leaky joints. DWV lines can be set right into the regular 2″ x 4″ studding without any extra furring out, are much, much lighter than conventional drainage material and do not require caulking. And, I've never known copper drainage or waste lines to clog, so that does away with expensive call-backs. Finally, copper gives you all these advantages for the same money as rustable materials."

. . . .

Engineers, contractors, home builders and architects have also found that copper water tube is equally important for use in air conditioning lines, radiant panel heating, oil burner and processing lines. It's also important that you specify a particular brand . . . Revere, the oldest name in copper.

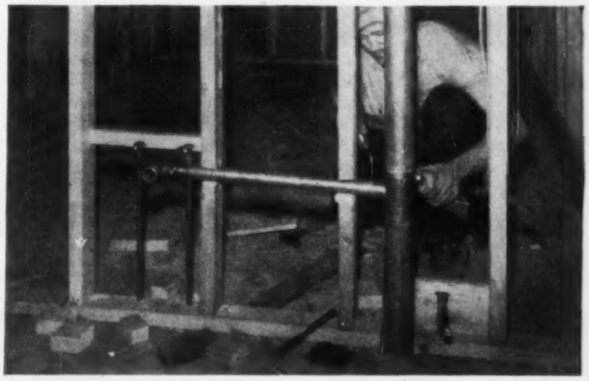
REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
Executive Offices: 230 Park Avenue, New York 17, N. Y.
Sales Offices in Principal Cities, Mills: Rome, N. Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb.
Distributors Everywhere.

"Copper
is the mark of
a quality installation
... makes homes
easier to sell,"

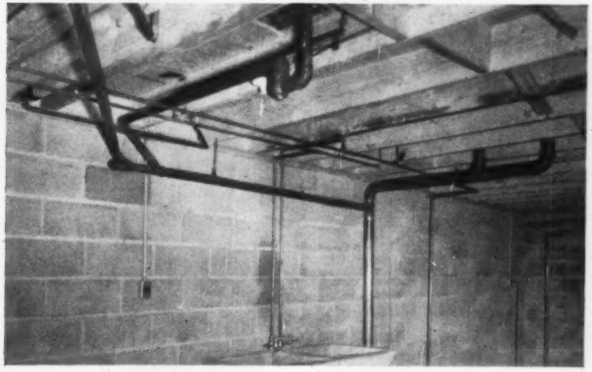
says H. C. O'Connor, *President*
BONWIN ACRES
Youngstown, N. Y.

BONWIN ACRES HOUSING PROJECT—YOUNGSTOWN, N.Y.

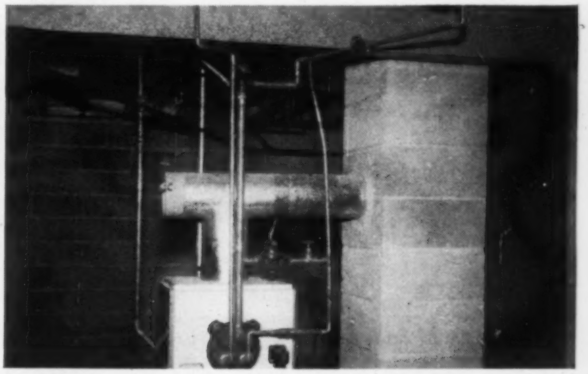
SECTION OF THE 110-HOME DEVELOPMENT AT Youngstown. Architects: SHACKLETON & FITZGERALD, Niagara Falls, N. Y. General Contractor: FRANK J. BALCERZAK & SON, INC., Medina, N. Y.



MAKING JOINTS IS A CINCH when you use Revere Copper Water Tube. Note how vent stack fits into standard 2" x 4" studding, and how easy it is to work in tight places.



THERE'S NOTHING NEATER THAN an all-copper job. 33,260 feet of Revere Copper Water Tube, in sizes from ½" to 3", were used for DWV, water service, plumbing and heating lines.



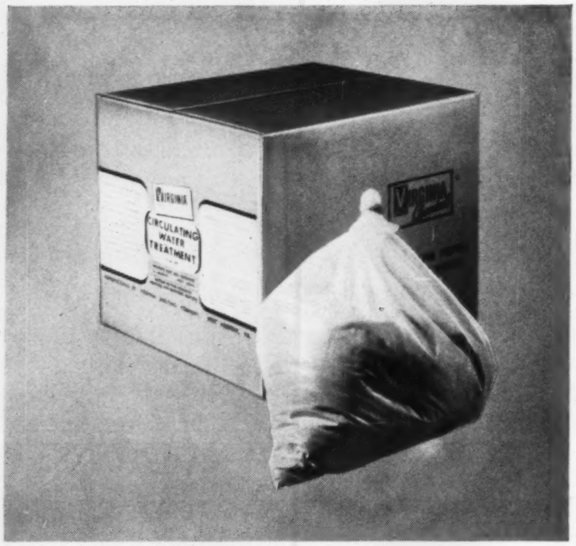
HERE YOU SEE HOT WATER BOILER HOOK-UP using Revere Copper Water Tube, which was furnished by Revere Distributors, WARD BROTHERS, Lockport, N. Y. and COMMERCIAL PIPE COMPANY, Buffalo, N. Y.

NOW, BIG BOILER TREATMENT

YOU PAY FOR THESE . . .

VIRGINIA Chemicals
SCALE REMOVER
VIRGINIA
SCALE REMOVER
(SOLID)

Liquid and Solid Scale Removers. The liquid is ideal for heavy scale removal, may be added directly to boiler. Inhibited to prevent metal damage, fast acting. The solid is preferred for live steam generators. Heavily inhibited. Nonvolatile. Liquid in 1 and 5-gal. plastic throwaways, solid in 10 or 50-lb. packages.


VIRGINIA
CIRCULATING WATER TREATMENT
VIRGINIA

Circulating Water Treatment. Halts corrosion, functions as an antioxidant, forms a protective film on metal surfaces in boiler and lines, keeps solids in suspension or liquid state. In 50-lb. drums containing 5 sealed 10-lb. plastic bags.

VIRGINIA
VIRGINIA FUEL OIL ADDITIVE
WEST NORFOLK VIRGINIA

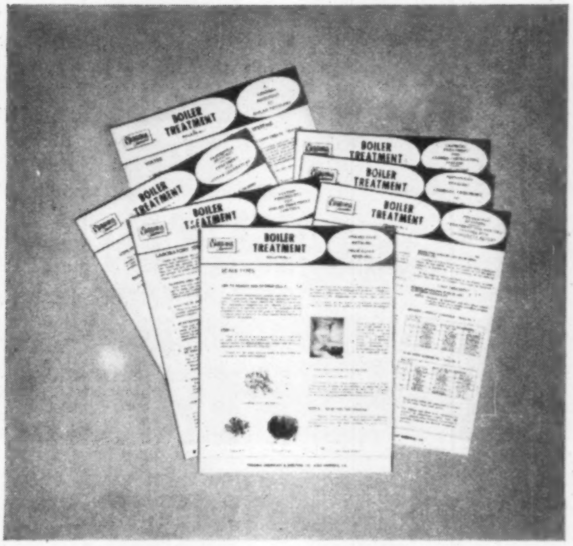
Fuel Oil Additive. A combustion catalyst combined with essential solvents and detergents to free tanks and lines from gum and sludges; promotes sootfree combustion; increases thermal efficiency up to 5%. In pint cans, 5, 28, and 53-gal. steel drums.

VIRGINIA
BOILER 2 WAY TREATMENT
BOILER 3 WAY TREATMENT
WEST NORFOLK, VIRGINIA

Boiler Protective Treatments. "Virginia" 2-Way Treatment for steam generators. Assists in production of steam free of carryover vapors, promotes smoother, quieter, more efficient boiling. "Virginia" 3-Way Treatment for condensate return boilers contains inhibiters that remain in boiler and volatile inhibiters that travel with steam and condensate. Both in 5, 28, and 53-gal. steel drums.

FOR SMALL BOILERS *(up to 300 psig)*

YOU GET THESE AT NO COST...



Technical Bulletins. Describing methods for treatment of steam condensate return systems; circulating hot water heating systems, live steam generators; chemical treatment of fuel oils.

Laboratory Services. A complete professional water treatment laboratory is at your service. Includes 30-day treatment checkup; water analysis; sludge analysis; special recommendations for unusual conditions.

Engineering Consultation. On-the-spot counsel from "Virginia's" water service engineers at your plant whenever a difficult problem arises.

For the first time, you get the same lab service, counsel and boiler protection available in the past only to large installations having their own professional staffs. The only cost to you is that of the chemicals needed, compounded by specialists to make your equipment work better and longer. This protection is yours at a cost so low you can't afford to be without it. Get the full details on the special "Virginia" plan for your installation. Send in the coupon today.

VIRGINIA Chemicals

Dept. B521
Refrigeration Division
Virginia Chemicals & Smelting Company
West Norfolk, Va.

Please send information on the special "Virginia" plan for chemical treatment of:

- ☐ Heating systems with condensate return
- ☐ Live steam generators
- ☐ Closed circulating hot or cold water systems
- ☐ Fuel oil treatment

Name____________________

Company____________________

Street____________________

City____________Zone____State____

Milady's Fan is just about the *only* fan you won't find in the complete Ilg line. So why go to the expense and bother of getting a propeller fan from one source . . . roof fans from another . . . centrifugals from a third? Ilg has them all . . . complete selection *within* each category, too.

And regardless of the Ilg fan you pick, you can be sure of performance as maintenance-free as a fan can be. Careful dynamic balancing of all component parts . . . plus electronic checks of Ilg-built motors and Ilg-patented Type "Q" propeller fan and centrifugal fan wheels . . . makes certain that smooth, vibration-free operation is as much a part of the product as the Ilg "One-Name-Plate" pledge of performance.

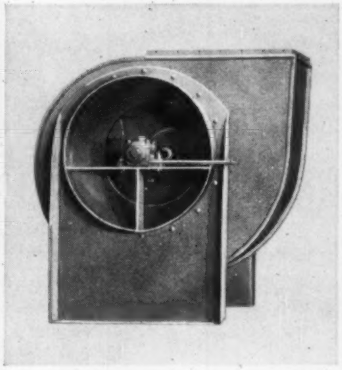
HERE'S ONE OF THE FEW FANS YOU CAN'T GET FROM

BE RIGHT . . . WRITE IN

ILG ®

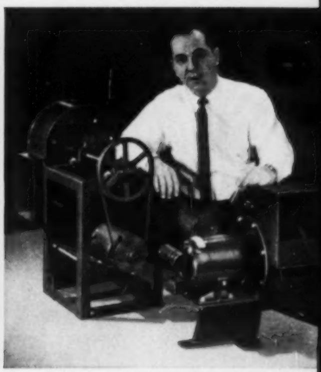
YOUR CHOICE OF CENTRIFUGAL FANS...

Ilg BC Airfoil Centrifugals. Direct-connected and belted types. Aluminum wheel and housing. Single and double width. WRITE FOR BULLETIN DB2-100.



Ilg BBS Belted Centrifugal Fan. Backward blade. Steel housing. Single and double width. WRITE FOR BULLETIN BB-105.

Ilg BU and FU Util-A-Sets. Belt drive. Forward curved wheel and backward blade types. Capacities up to 23,000 CFM. WRITE FOR BULLETIN DB2-200.

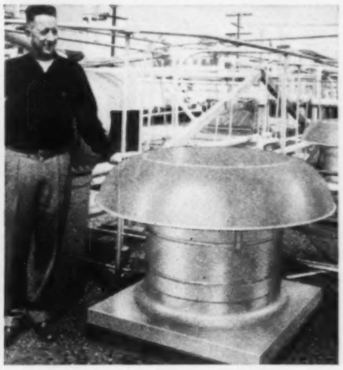


Ilg Type B Direct-Connected and Type FU Belted Util-A-Sets. Forward curved wheels. Capacities up to 2400 CFM. WRITE FOR CATALOG DB2-306.

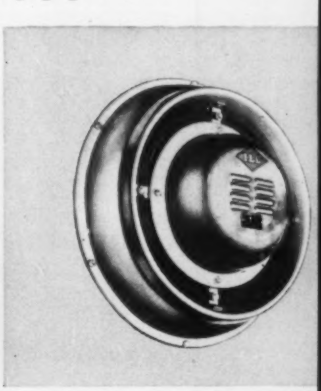
PROPELLER AND CENTRIFUGAL ROOF FANS...

Ilg UB Upblast Roof Ventilators with butterfly dampers. Direct-connected. Airfoil blades. 5 sizes. WRITE FOR BULLETIN DB3-300.

Ilg L-CRF Airfoil Centrifugal Fan Roof Ventilators with patented pressure-cooled direct-connected motor. 15 sizes. WRITE FOR BULLETIN DB3-200.

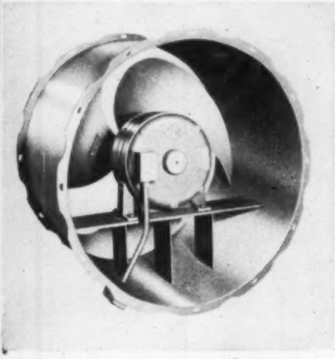


Ilg L-LSQ Propeller Fan Roof Ventilators. Direct-connected. Type "Q" wheel. 11 sizes. WRITE FOR BULLETIN. DB3-100.

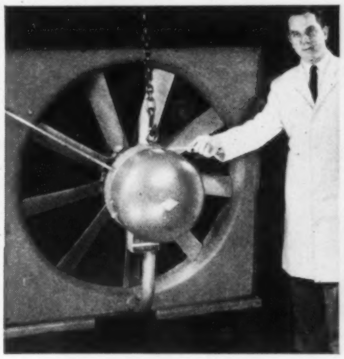


Ilg Type CWF Airfoil Centrifugal Wall Exhausters. Direct-connected, pressure-cooled motor. 5 sizes. WRITE FOR BULLETIN DB3-200.

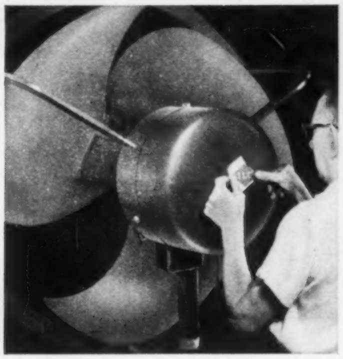
DIRECT-CONNECTED AND BELTED PROPELLER FANS



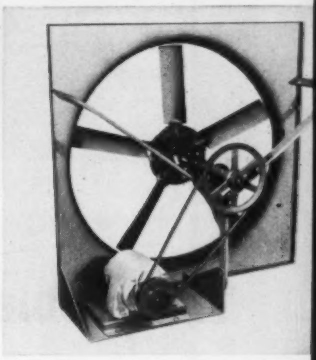
Ilg TA Tubeaxial Propeller Fans. Direct-drive. 3-blade and 5-blade design. Totally enclosed motors. 8 sizes. WRITE FOR BULLETIN DB1-100.



Ilg PF Square Panel Propeller Fans. Direct-connected, self-cooled motors. Airfoil design and Type "Q" blades. WRITE FOR BULLETIN DB1-106.



Ilg LQ Propeller Fans. Direct-connected. Self-cooled motor. Patented Type "Q" wheel. WRITE FOR BULLETIN DB1-100.



Ilg Type PFB Belted Propeller Fans. 5-blade airfoil design. Totally enclosed motors. 3 sizes. WRITE FOR BULLLETIN.

ILG ELECTRIC VENTILATING CO.

2826 No. Pulaski Road, Chicago 41, Ill.
Offices in 60 Principal Cities
Member of Air Moving and Conditioning Association, Inc. (AMCA)

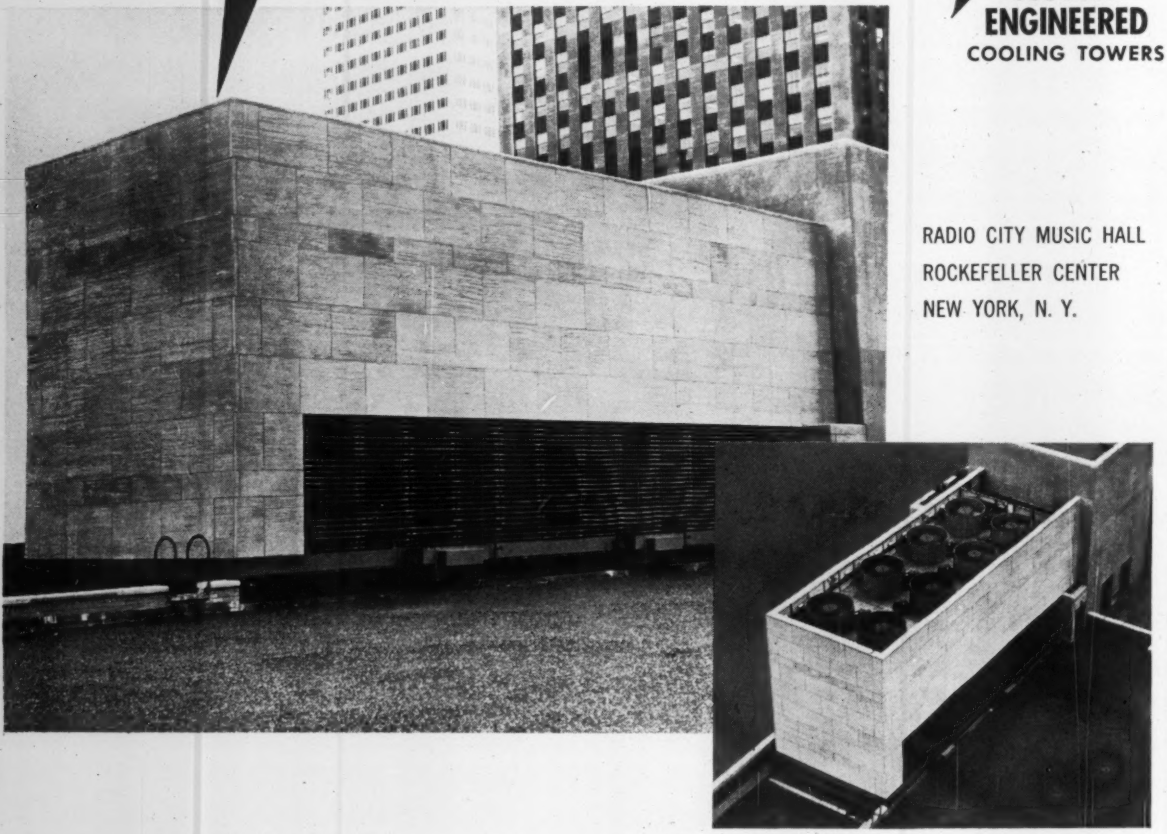
CERTIFIED RATINGS
AUTHORIZED BY
AMCA

Each Ilg product shown carries the rating seal of the Air Moving and Conditioning Association, Inc.

Here's how Phillips solves

another problem solved by Phillips

CUSTOM ENGINEERED
COOLING TOWERS



RADIO CITY MUSIC HALL
ROCKEFELLER CENTER
NEW YORK, N. Y.

The problem:

Combining beauty and efficiency in a limited space at low cost.

The solution:

PHILLIPS CUSTOM ENGINEERED COOLING TOWER with limestone casing to blend perfectly with surroundings. Space utilized so that additional tower may be erected as need arises. This tower gives maximum cooling surface per foot of space, and minimum maintenance cost.

cooling tower problems CUSTOM ENGINEERING

Whatever the problem — noise . . . freezing . . . space . . . maintenance . . . atmospheric conditions — you'll find PHILLIPS CUSTOM ENGINEERED COOLING TOWERS solve the problem better . . . at less cost. Why? Because here are the only cooling towers that are custom engineered to suit the conditions of each application. No wonder each year, more and more specifications call for PHILLIPS CUSTOM ENGINEERED COOLING TOWERS.

EVERY STEP CUSTOM ENGINEERED

CASINGS
Selection of material to fit Architectural treatment and surrounding conditions.

BASINS
Redwood, stainless steel, galvanized steel, carbon steel up to and including ¼" thickness with any desired coating, reinforced concrete basins supported on steel beams.

FILL
Redwood or pressure treated Douglas Fir. Slip-fit, self-supporting for easy removal for interior maintenance.

FANS
Multi-blade, adjustable propeller type fan in cast aluminum, stainless steel or Monel. Either direct driven fan in small sizes or indirect right angle worm gear drives.

DISTRIBUTION SYSTEM
Spray nozzle type or open Weir gravatational type system.

FRAMEWORK
Hot dipped galvanized structural steel .250" minimum thickness. Redwood or pressure treated Douglas Fir.

Write for literature

SPECIAL FEATURES ON ALL TOWERS

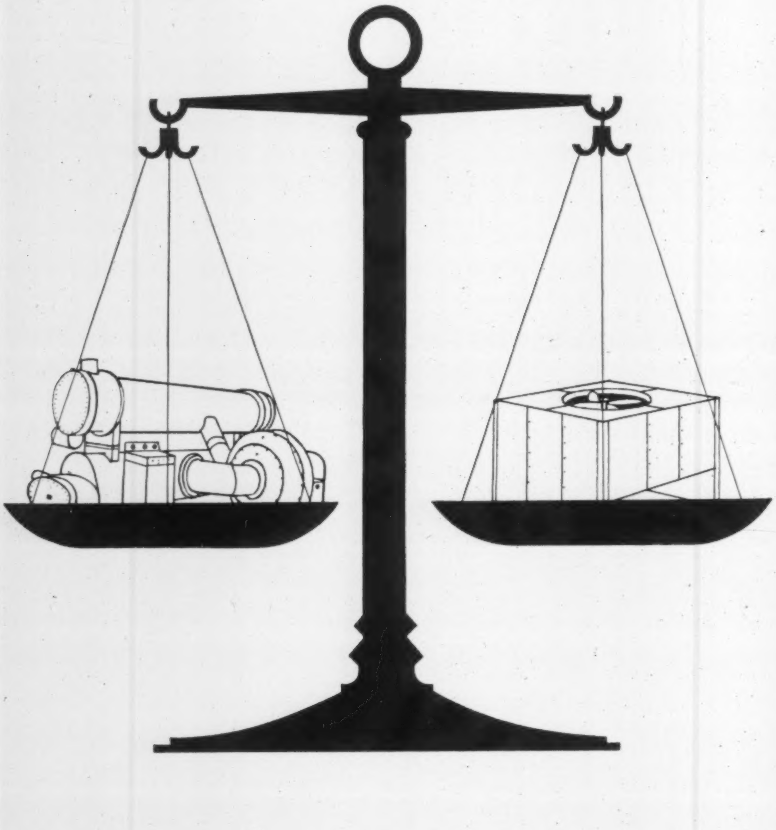
Corrosion Resistant Hardware. Aluminum or Stainless Steel Fans. Nailless Redwood Filling Removable at Tower Base. Nailless Three-Pass Redwood Eliminators. Removable Louvers.

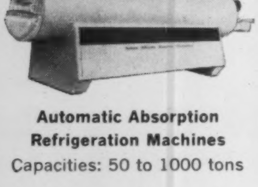
Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N. Y.

From 5 to 5000 tons...

CARRIER OFFERS BALANCED REFRIGERATION SYSTEMS

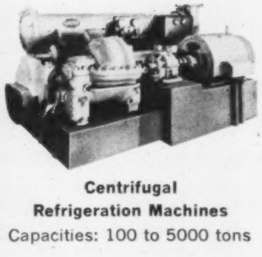
for any air conditioning or process cooling job





Automatic Absorption Refrigeration Machines
Capacities: 50 to 1000 tons

Hermetic Centrifugal Liquid Chilling Packages
Capacities: 100 to 2000 tons



Centrifugal Refrigeration Machines
Capacities: 100 to 5000 tons

Induced Draft Cooling Towers
Capacities: 170 tons and up

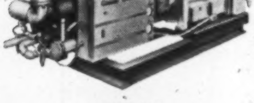
ADVANTAGES:

- **Combined ratings simplify system design**
- **Undivided responsibility for entire package**
- **All components matched and full rated capacity**
- **Lower over-all owning and operating costs**

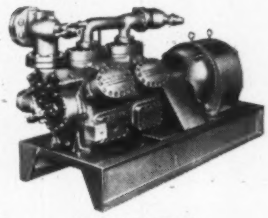
Designed to complement each other, Carrier offers a complete line of matching components—refrigeration machines, condensers and cooling towers—to accommodate the requirements of any commercial or industrial application. But the completeness of the Carrier line is not nearly so significant as the advantages that result from your making full use of it—simplified selection and design . . . dealings from job's start to finish with one responsible source for all components . . . and finally, a balanced system that assures your customer of maximum efficiency with minimum owning and operating cost.

The reliability of Carrier refrigeration equipment has been proven on thousands of jobs, small and large, all over the world. Some of this equipment is shown here. For complete information . . . or information about components for a specific job . . . call your Carrier representative. Or write Carrier Air Conditioning Company, Syracuse 1, New York. In Canada: Carrier Air Conditioning Ltd., Toronto 14.

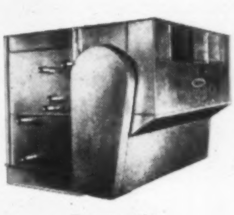
Carrier *Air Conditioning Company*



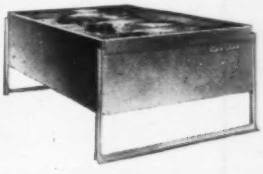
Liquid Chilling Packages
Capacities: 15 to 125 tons



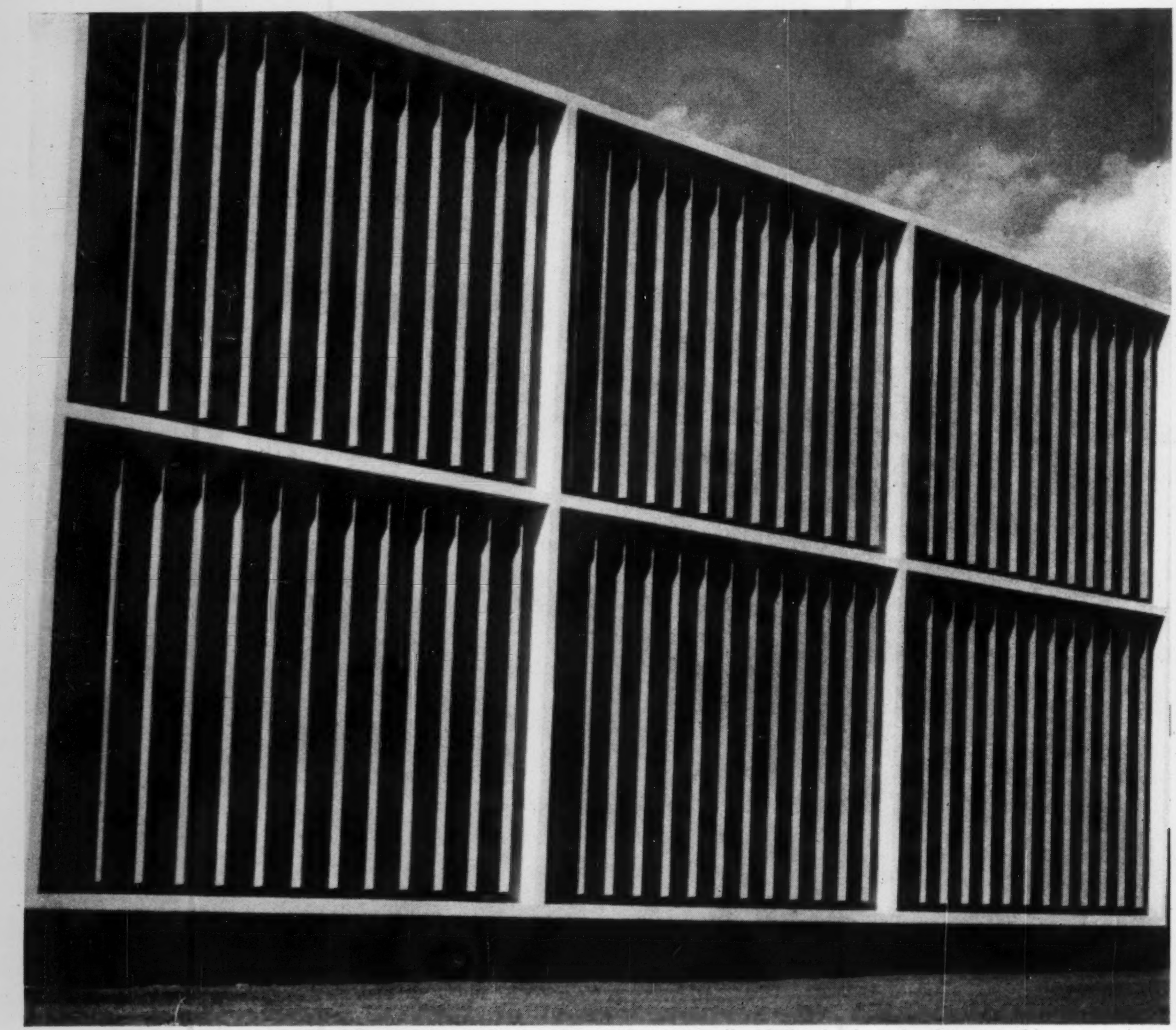
Reciprocating Compressors
Capacities: 5 to 250 tons



Evaporative Condensers
Capacities: 10 to 250 tons



Air-cooled Condensers
Capacities: 5 tons and up



The Arkla Gas air conditioning unit uses the same gas-fired boiler that heats in winter to cool in summer.

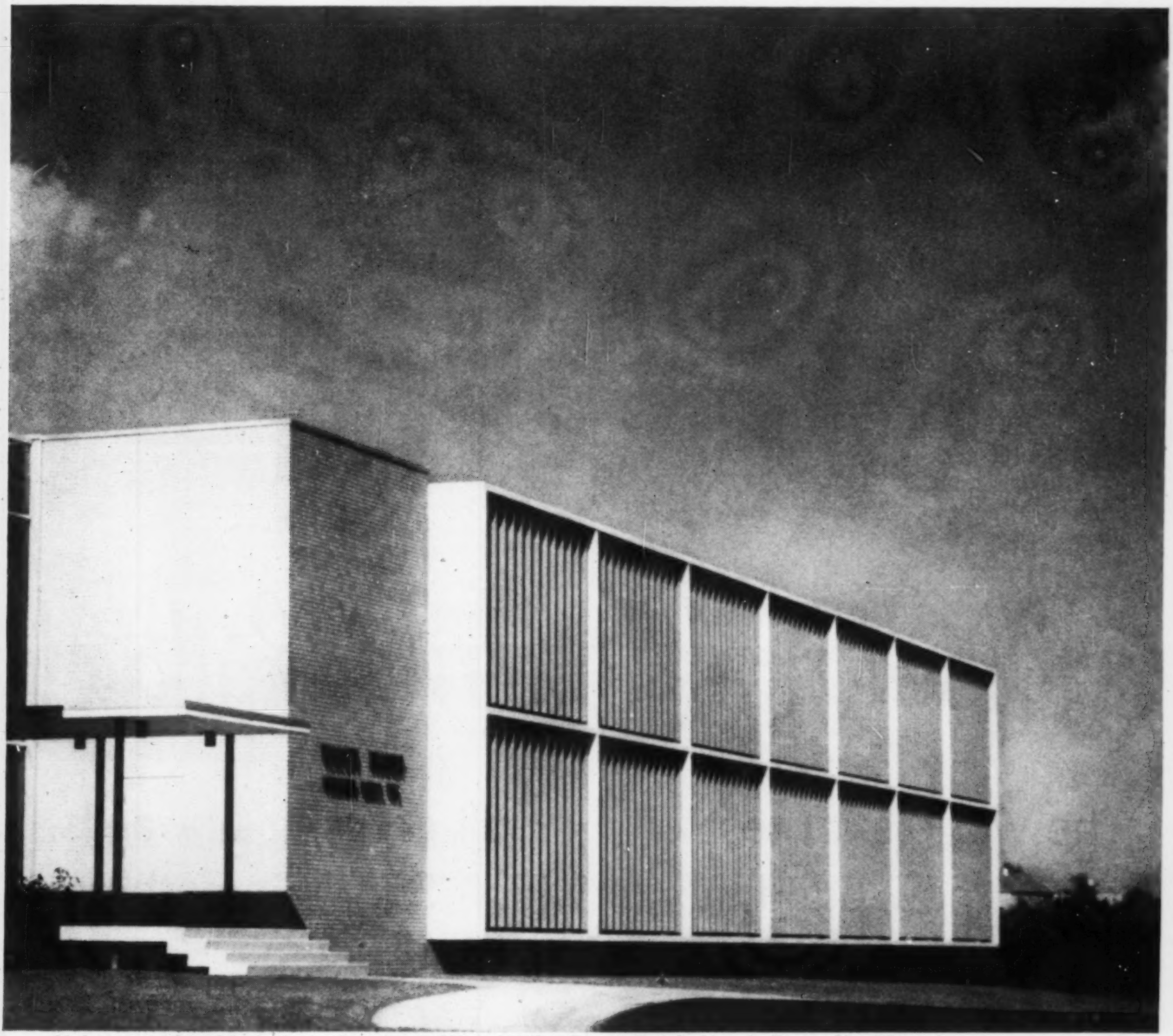
As the Building grows, the ARKLA

The headquarters building of Yellow Transit Freight Lines, Kansas City, Missouri, was designed to take a third story without major alterations. That's why they chose Arkla gas cooling units . . . a system that can "grow" quickly and at low cost.

When the building expands, they'll just add an Arkla unit. They go on the line right next to the rest, using the same basic piping — and steam from the same gas-fired boiler that energizes all the Arkla units.

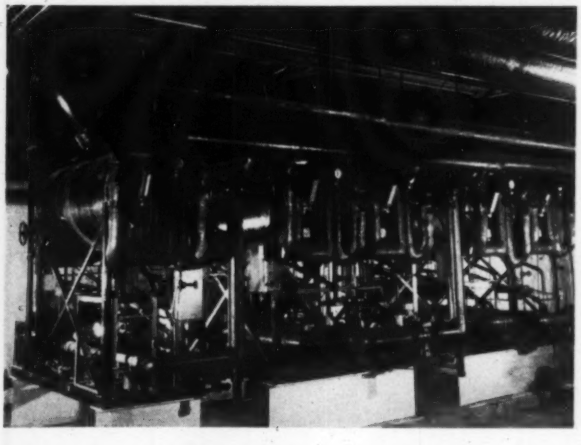
The present cooling system includes five 25-ton Arkla Gas

Architect: Folger & Pearson;
Mechanical Contractors: Troug & Nichols.



Modern gas cools and heats this headquarters building of Yellow Transit Freight Lines in Kansas City, Missouri.

GAS COOLING system grows with it



Absorption Water Chillers. These versatile units use steam from the gas-fired boiler to provide chilled water for comfort cooling. The same boiler heats in winter. And thrifty gas keeps fuel costs low.

For specific information on Arkla gas air conditioning, call your local Gas Company. Or write Arkla Air Conditioning Corporation, General Sales Office, 812 Main Street, Little Rock, Arkansas. *American Gas Association.*

FOR HEATING & COOLING...GAS IS GOOD BUSINESS!

For increased cooling capacity, at low cost, additional Arkla units can be installed.

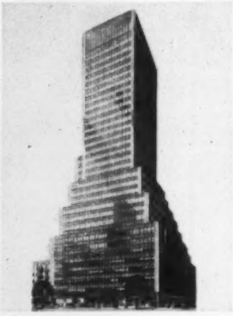
DAILY NEWS BUILDING
Contractor:
Alvord & Swift
Architect:
Harrison & Abramovitz
Engineer:
Meyer, Strong & Jones

CHASE MANHATTAN BANK
Contractor:
Raisler Corporation;
Kerby Saunders, Inc.
Architect:
Skidmore, Owings & Merrill
Engineer:
Jaros, Baum & Bolles

320 PARK AVENUE
Contractor:
Raisler Corporation
Architect:
Emery Roth & Sons
Engineer:
Henry B. Oehrig

GETTY BUILDING
Contractor:
Raisler Corporation
Architect:
Emery Roth & Sons
Engineer:
Robert C. Ebner

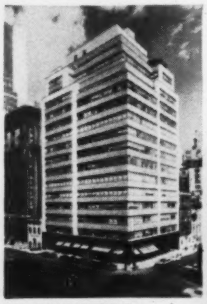
575 LEXINGTON AVENUE
Contractor:
Raisler Corporation
Architect:
Sylvan Bien
Engineer:
Sears & Kopf



All new! All in Manhattan!

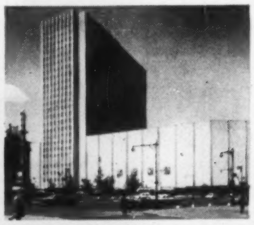
The world's largest city is still growing upwards. new buildings in which Sarco-Sarcotherm

* **HEATING CONTROL SYSTEMS** for all types of heating, fully modulated, with complete automatic program panels. **STEAM TRAPS** of all 5 types, offered only by Sarco. **BALANCING FITTINGS** with unique solid segment stem for positive control. **RADIATOR VALVES** in a complete quality line, for steam or hot water. **CONDENSATE AND VACUUM PUMPS,** efficient, rugged, built to highest standards. **HEATING SPECIALTIES** including radiator traps, protective strainers, air eliminators and water blenders. The **SARCO-SARCOTHERM** name is assurance of excellence in heat conservation and control.



405 PARK AVENUE
Contractor:
Raisler Corporation
Architect:
Herbert Tannenbaum
Engineer:
Jaros, Baum & Bolles

LIBRARY & CLASSROOM BLDG.
Contractor:
Brandt Corporation
Architect:
O'Connor and Kilham
Engineer:
James Mongitore & Associates



NEW YORK COLISEUM
Contractor:
Almirall & Company, Inc.
Architect:
Leon and Lionel Levy
Engineer:
Structural—Jacob Feld, Phd.
Mechanical—Guy B. Panero, Engineers

SARCO

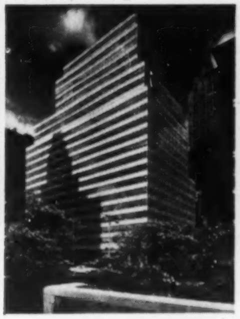
SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

I.B.M. WORLD TRADE CORPORATION
Contractor:
James H. Merritt & Company
Architect:
Harrison & Abramovitz
Engineer:
Meyer, Strong & Jones

EQUITABLE LIFE BUILDING
Contractor:
Kerby Saunders, Inc.
Architect:
Skidmore, Owings & Merrill
Engineer:
Meyer, Strong & Jones

300 PARK AVENUE
Contractor:
Raisler Corporation
Architect:
Emery Roth & Sons
Engineer:
Henry B. Oehrig



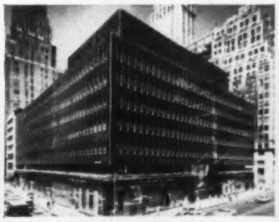
UNION CARBIDE BUILDING
Contractor:
Kerby Saunders, Inc.;
Raisler Corporation
Architect:
Skidmore, Owings & Merrill
Engineer:
Syska & Hennessy

730 THIRD AVENUE
Contractor:
Wolff & Munier, Inc.
Architect:
Carson & Lundin
Engineer:
Jaros, Baum & Bolles

All equipped by Sarco-Sarcotherm*

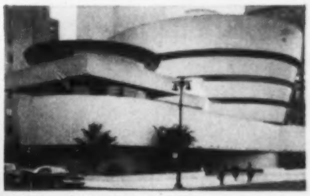
Here are just a few of the fabulous products have been installed.

SKYLINE MOTOR INN
Contractor:
Fein-Schlossberg, Inc.
Architect:
Leo Stillman
Engineer:
Kalfus & Lovett



C.I.T. FINANCIAL BUILDING
Contractor:
Almirall & Company, Inc.
Architect:
Harrison & Abramovitz
Engineer:
Jaros, Baum & Bolles

N.Y.U. LOEB STUDENT CENTER
Contractor:
Raymar Contract Corp.
Architect:
Harrison & Abramovitz
Engineer:
Jaros, Baum & Bolles



GUGGENHEIM MUSEUM
Contractor:
Euclid Contractor Corp.
Architect:
Frank Lloyd Wright

2959

SARCOTHERM

SARCOTHERM CONTROLS, INC.
AN AFFILIATE OF SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.

CONTROL SYSTEMS FOR STEAM, HOT WATER, AND RADIANT HEATING

HARDWORKING CENTURY MOTORS MOVE AIR AND WATER FOR CONTINUOUS PROCESS

Air and steam condensate vital to continuous production of wall board are kept moving dependably—and the plant is kept running—by fans and pumps powered by Century integral horsepower motors.

Take the exhaust fan motor at the left, for example. These 75-hp, 1170-rpm, squirrel-cage motors power fans that pull exhaust air from a pneumatic conveying system through Cottrell precipitators. The air conveys gypsum dust in process. The air must be pulled through the precipitators for cleaning before being exhausted to the atmosphere. This round-the-clock dust control is necessary to prevent harmful contamination of the plant atmosphere as well as the surrounding community.

The two 30-hp, 1750-rpm totally-enclosed fan-cooled motors above operate boiler condensate return pumps. The motors are in hot pits. Because the pits are under a plant roadway, everything in them becomes laden with dirt and grease that drops off of trucks passing over head.

Process air for conveying gypsum dust and process condensate are both required continuously to keep this plant operating. These rugged, well-protected Century motors keep these vital process elements flowing.

Other Century motors at work in this plant drive ventilating fans, conveyor lines, crushers, pulverizers, and dust flues. Each provides power for a different job in a different place.

Each of these Century motors was carefully selected for its particular job by plant engineers working closely with Century motor specialists. Speed, torque, voltage, power factor, starting current, load requirements, and environmental conditions were carefully evaluated before selecting horsepower, motor type, and enclosure.

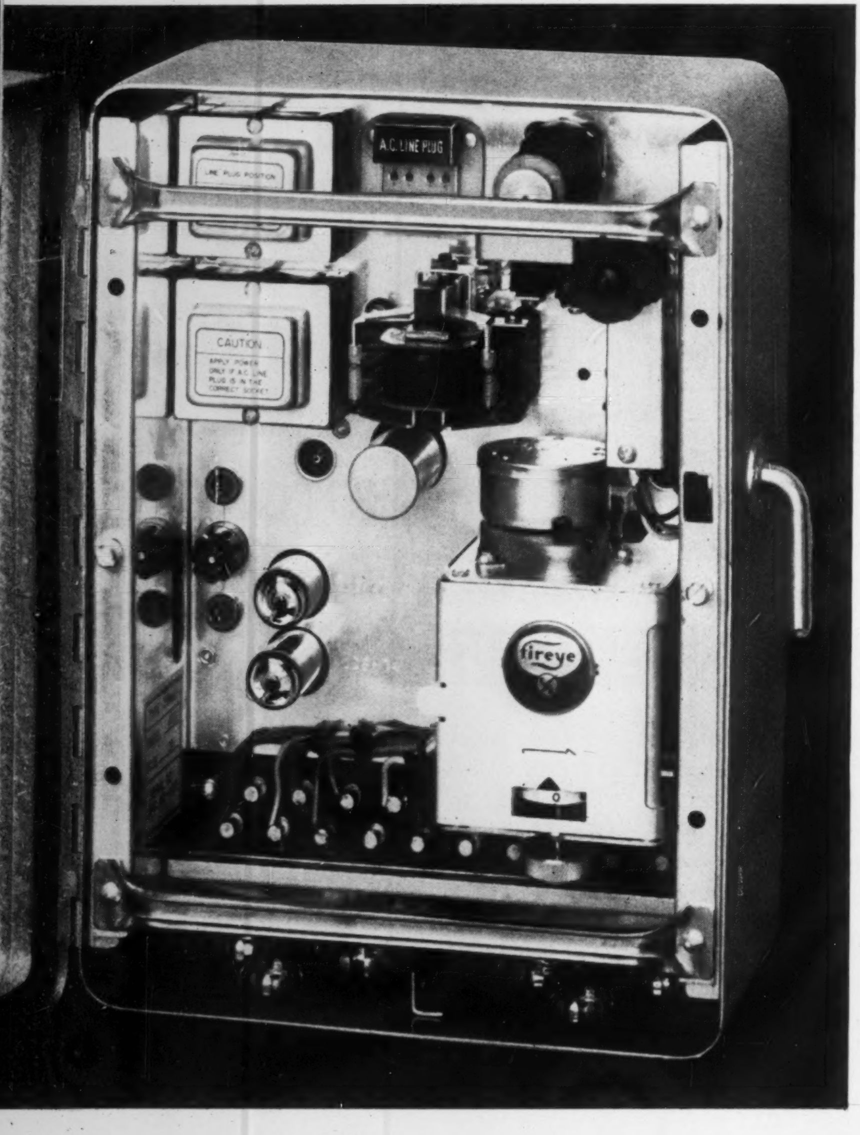
Ask your Century representative (he's a full-time motor specialist) for assistance with your motor application problems. You'll find that he knows his business, and can help you in yours.

CENTURY ELECTRIC COMPANY

St. Louis 66, Missouri *Offices and Stock Points in Principal Cities*

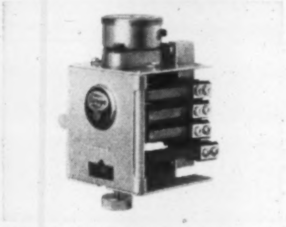
61-6

NOW...An Important Advancement in FIREYE Systems

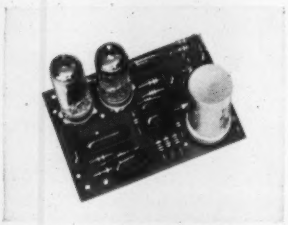


for Flame Safeguard and Programming Control

You get all these Extra Features at No Extra Cost



1 — SYNCHRONOUS MOTOR TIMER
No electronics in this critical part. Timing is not influenced by line voltage variations.



2 — PRINTED CIRCUIT BOARD
eliminates complex wiring. Connections are dip soldered for trouble-free operation.

3 — IMPROVED ELECTRONIC CIRCUIT
requires fewer tubes.

4 — NEW FUSED FUEL VALVE CIRCUIT
provides an additional safety factor.

5 — NEW COLD SAFE START CHECK
provides a circuit check on every cycle from the moment the control is powered. Also checks operation of flame relay.

6 — NEW MULTI-VOLTAGE LINE PLUG
Connections provided for 120v., 208v., 240v.

Long rated best by those who know most about protection systems for automatic burners : . . the choice of 9 out of 10 burner-boiler manufacturers . . . the famous FIREYE FP-2 now is even more reliable and convenient.

You'll find many important advancements in this new model FP-2. But there is no change in the basic design and outstanding quality which have won your favor through the years.

You get the Firetron infra-red sensitive cell for visual supervision of both oil and gas flames. Perfected and proved in a half million installations, the Firetron scanner has no equal.

You get rugged construction and a control that's easy to understand, install and service.

You get completely approved protection . . . whatever the Codes call for, Fireye performs in fullest measure.

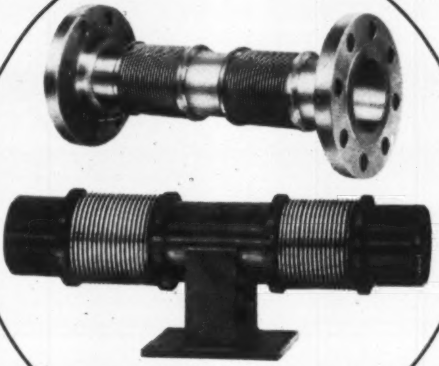
The new FP-2 system, Model 6018, is completely interchangeable with the former model. WRITE FOR informative Bulletin CP-51. Combustion Control Division, Electronics Corporation of America, One Memorial Drive, Cambridge 42, Mass. In Canada: Electronics Corporation of America (Canada) Ltd., 104 Advance Road, Toronto 18, Ontario.

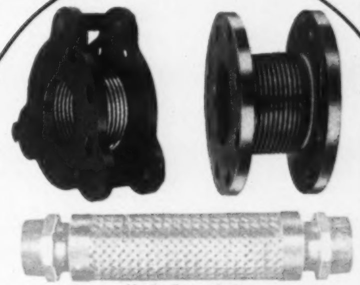
UL FM

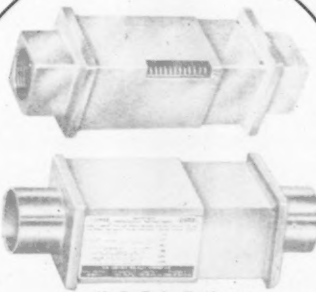
ECA **fireye**

KEFLEX

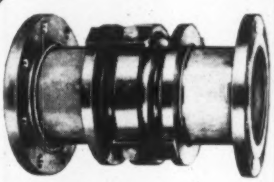
BELLOWS TYPE EXPANSION JOINTS
VIBRATION ABSORBERS
FLEXIBLE CONNECTORS


KEFLEX
EXPANSION JOINTS


KEFLEX
FLEXIBLE CONNECTORS
and
VIBRATION ABSORBERS


KEFLEX
EXPANSION COMPENSATORS
Pat. No. 2,931,669

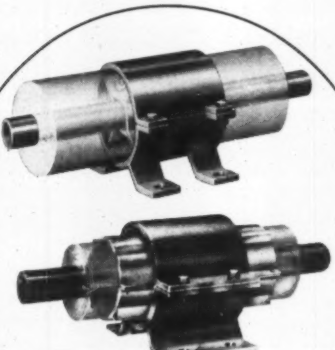
From Boiler Room to the "Quiet Zone" of churches, schools and wherever concentrating personnel is located, a Keflex expansion joint is available to help reduce distracting noises caused by pipe movement in the heating and cooling lines.


KEFLEX
GIMBAL UNIT

In the Mechanical Room Keflex Flexible Connectors and Vibration Absorbers relieve pumps, chillers, compressors and other equipment from piping stresses.

In Process Plants for steam or products lines, or on military bases for conveying liquid oxygen, a Keflex laminated stainless steel bellows assembly will provide maximum safety.

See our catalog in Sweet's or write for a copy. We shall be pleased to send you the name of our nearest agent.


KEFLEX-MAVE
PIPE GUIDES

KEFLEX MANUFACTURING DIVISION
U. S. FLEXIBLE METALLIC TUBING CO.
Since 1905

General Offices—63 Main St., San Francisco 5, Calif.
Factories—Los Angeles - San Francisco

At Diebold, Inc., a total of 300 Perfection Schwank Gas *Infra-Red Heaters maintain a constant 70° in 11*

Diebold Cuts Heating Costs 35% . . . with

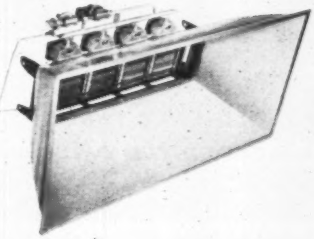
"We know it sounds impossible, but our Perfection Schwank *Gas* Infra-Red Heating System has reduced heating costs 35%," says William Roby, Assistant Plant Engineer at Diebold, Inc., Canton, Ohio. "Heating comfort alone would have justified our investment, but here's the clincher. In another 2½ years, our tangible savings in heating costs will have completely paid for the entire *gas* infra-red system! Gas keeps the *fuel* cost low. And there are practically no maintenance costs."

"It's as simple as this . . . in the Fall we turn the *gas*-fired system on . . . and in the Spring we turn it off. In nearly two full heating seasons, our total heating maintenance was a single dusting of the *gas* infra-red heaters. The *gas*-fired Perfection Schwank System keeps materials, floors, and machinery at a constant, uniform 70° – *an ideal temperature for employees.* What's more, the system is completely noiseless and draftless; prevents corrosion and maintains humidity at an optimum level for efficient production."

uninsulated buildings with total floor space of 180,500 sq. ft. and a total volume of 6,500,000 cu. ft.

Perfection Schwank Gas Infra-Red Heaters

As over 30,000 users have discovered, Perfection Schwank *Gas* Infra-Red Heaters give all the advantages of modern *gas* heat... high efficiency, precise control, speed, safety, cleanliness, dependability and unbeatable fuel economy.



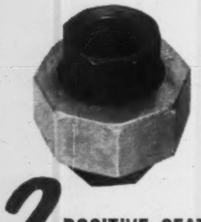
Heat better for less with Perfection Schwank *Gas* Infra-Red Heaters. For complete information, contact your local Gas Company or write to Perfection Division of Hupp Corporation, licensee of American Infra-Red Radiant Co., 1135 Ivanhoe Rd., Cleveland 10, Ohio. *American Gas Association.*

Approved by A.G.A., Underwriters, C.G.A. and C.S.A.
Under Schwank U.S. Patents 2,775,294 and 2,870,830
and pending applications.

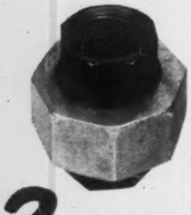
FOR INDUSTRIAL HEATING
... GAS IS GOOD BUSINESS!

Low Water Cut-offs on Hot Water Boilers?

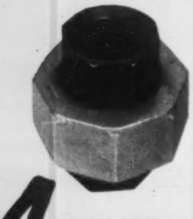
1 LEAK-PROOF CONNECTIONS



2 POSITIVE SEATING



3 CLEAN/OVER-ALL PROTECTION



4 EASY WRENCHING FAST MAKE-UP

1,000,000 × 4

More than one million Capitol forged steel unions are now in service . . . and not a single failure! Capitol has 4-way built-in insurance to give trouble-free service. Each one of the million has this exclusive combination of 4 engineering features:

(1) *Leak-proof connections* assured because Capitol unions have *more* threads, accurately cut and double-checked according to Army-Navy gauging practice. Both hand-tight and pressure-tight threads are checked, two operations instead of the one required for American Standard gauging. The extra threads mean on-the-job assurance of tight installations. (2) *Positive seating* because each union is individually pressure-tested. (3) *Clean/over-all protection,* each male and female part completely phosphate coated; each nut electro-zinc plated. (4) *Easy wrenching/faster make-up* because all three parts have a definite octagon shape.

You get all 4 important advantages at no extra cost when you specify CAPITOL forged steel unions . . . one of the full-line of Army-Navy gauged forged steel fittings. Now more than one million in service . . . and not a single failure.

CAPITOL MANUFACTURING CO.,

Division of Harsco Corporation, Columbus, Ohio.

CAPITOL

SPECIFY CAP FOR ALL FITTINGS

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

Low Water Cut-offs on Hot Water Boilers?!

...the industry has given the answer

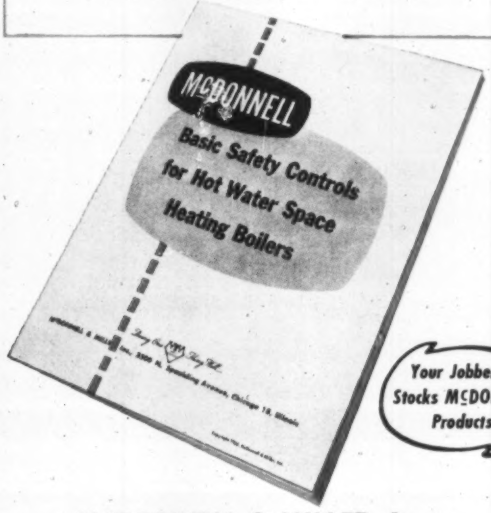
Yes, the answer has come from the field . . . from the engineers, contractors and manufacturers. They have seen the logic of installing a water level control on hot water space heating boilers . . . a low water cut-off, or—for even greater precaution—a feeder cut-off combination.

We knew it was a good idea. Expected it to grow and grow. But frankly we have been surprised at how rapidly the heating industry has taken hold of water level control as a logical team mate for an ASME pressure relief valve.

In fact, many local codes now require a low water cut-off, or feeder cut-off combination, on hot water boilers installed in places of public occupancy—including multiple dwelling units.

Notice the diagrams of recommended in-installations opposite. For more detailed discussion get this booklet that tells the whole story: "Basic Safety Controls for Hot Water Space Heating Boilers."

The What-Why-How
in eight interesting pages
Write for Bulletin P-30C


McDONNELL
Basic Safety Controls for Hot Water Space Heating Boilers

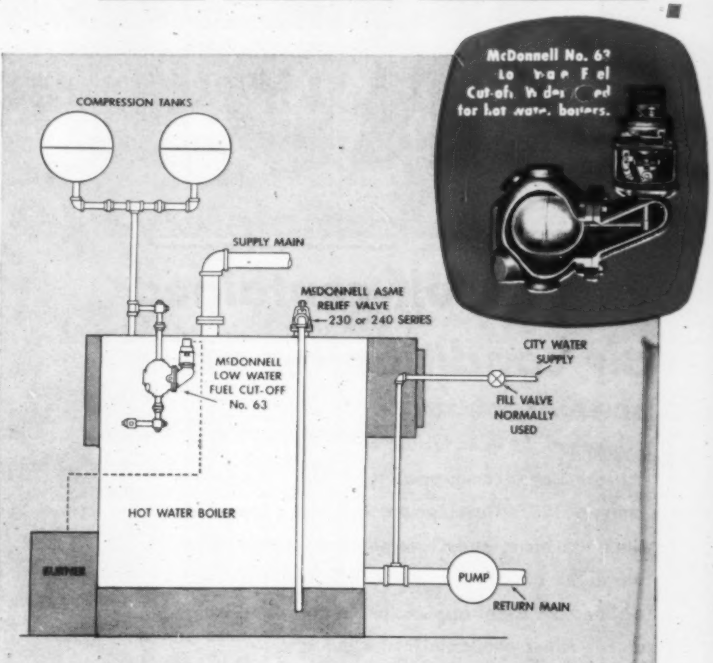
Your Jobber Stocks McDONNELL Products

McDONNELL & MILLER, *Inc.*
3500 N. Spaulding Ave., Chicago 18, Ill.

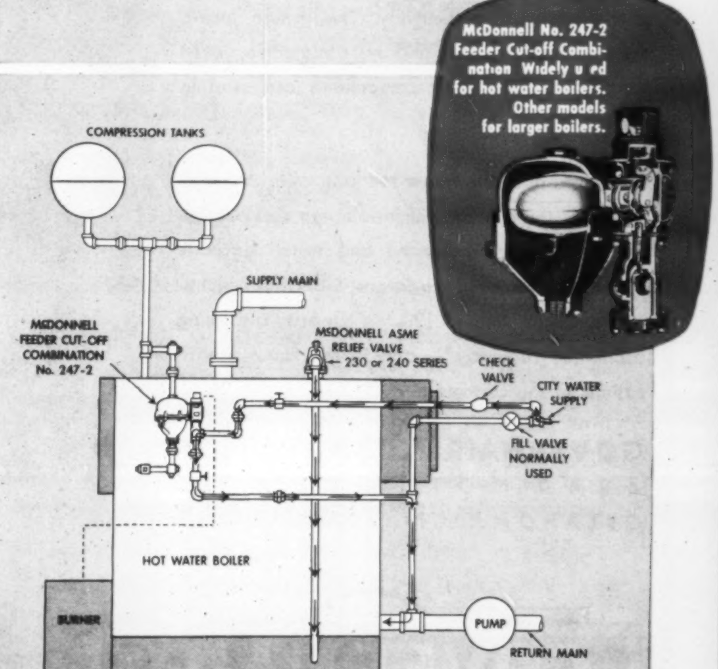
Doing One SAFETY *Thing Well*

McDONNELL

Boiler Water Level Controls


McDonnell No. 63 Low Water Fuel Cut-off Widely used for hot water boilers.
COMPRESSION TANKS
SUPPLY MAIN
McDONNELL ASME RELIEF VALVE
230 or 240 SERIES
McDONNELL LOW WATER FUEL CUT-OFF No. 63
CITY WATER SUPPLY
FILL VALVE NORMALLY USED
HOT WATER BOILER
BURNER
PUMP
RETURN MAIN

1 The essential low water control for a hot water boiler. A McDonnell Low Water Cut-off located above lowest permissable water level; also McDonnell A.S.M.E. Pressure Relief Valve.


McDonnell No. 247-2 Feeder Cut-off Combination Widely used for hot water boilers. Other models for larger boilers.
COMPRESSION TANKS
SUPPLY MAIN
McDONNELL FEEDER CUT-OFF COMBINATION No. 247-2
McDONNELL ASME RELIEF VALVE
230 or 240 SERIES
CHECK VALVE
CITY WATER SUPPLY
FILL VALVE NORMALLY USED
HOT WATER BOILER
BURNER
PUMP
RETURN MAIN

2 The safest and most complete control for a hot water boiler. Offers a combination of mechanical and electrical safeguards which is today's best and most complete answer. A McDonnell combination Boiler Water Feeder and Low Water Cut-off; also McDonnell A.S.M.E. Pressure Relief Valve.

FIRST

TO MANUFACTURE
TO DEVELOP

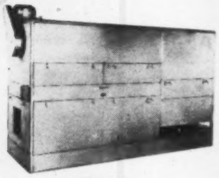
completely self-contained air conditioning units

GOVERNAIR CORPORATION

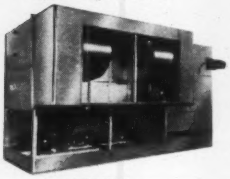
. . . began the manufacture of the first completely self-contained commercial type air conditioning units in 1937. Development has been continuous since that time, and Governair now manufactures packaged air conditioning units, for both commercial and industrial application, in the widest range of capacities available in the industry.

Governair Corporation also constantly recognizes the importance of producing a high quality, completely flexible system to benefit the end user best. Production facilities are tailored to accomplish these ends economically. This, in turn, makes the Governair prices highly competitive, even though only the finest components are used in the assembly.

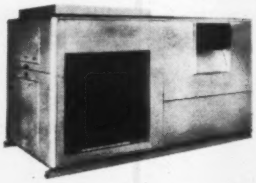
Development of the larger tonnage units has made available the economy of installation and reliability of a factory balanced and tested package system . . . for even the largest industrial requirements. Single units of 120 ton capacity are being fabricated regularly — and to the exact specifications of the customer.



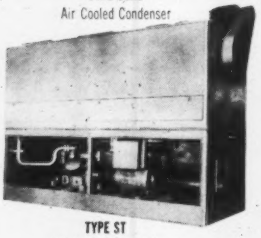
TYPE SCU
Evaporative Condenser Model



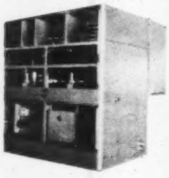
TYPE SCMZ
Complete Multi-Zone Package



TYPE SCAC
Air Cooled Condenser



TYPE ST
Water Cooled Model



TYPE STMZ
Water Cooled Multi-Zone

GOVERNAIR CORPORATION
4840 NORTH SEWELL
OKLAHOMA CITY, OKLAHOMA

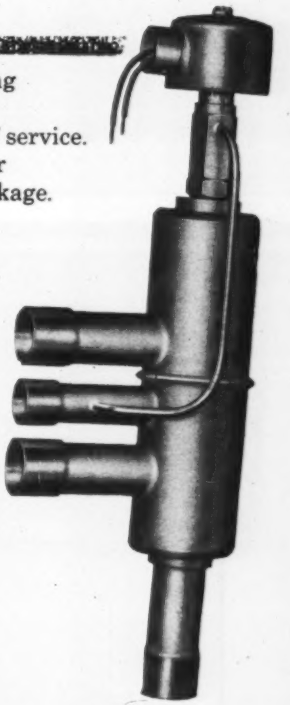
GOVERNAIR

Write for detailed information, or consult your yellow page directory for the name of our local representative.

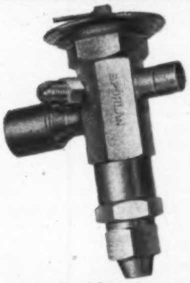
Buy SPORLAN

REVERSING VALVES
THERMOSTATIC EXPANSION VALVES
REFRIGERANT DISTRIBUTORS
CATCH-ALLS
SEE • ALLS

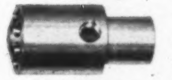
for HEAT PUMP *peak performance*



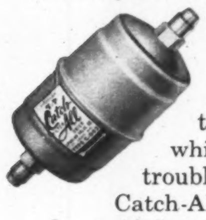
Sporlan Reversing Valves the reliable 4-way change-over control with the new Floating Ring design. Proven synthetic seating material assures complete tightness under all operating conditions throughout many years of service. No close fitting metal-to-metal sliding seals to wedge, corrode or wear, with resultant erratic performance or by-pass leakage.



Sporlan Thermostatic Expansion Valves are specifically designed for heat pump applications with elements made to meet their unusual operating requirements. Rugged in construction to withstand high pressures . . . with diaphragms designed for long life. Special selective charges maintain control of the system under extreme variations of ambient temperatures.



Only Sporlan Offers Refrigerant Distributors with auxiliary side connections for reverse cycle applications . . . plus the versatile interchangeable nozzle that gives you peak coil performance on heat pumps.



The Sporlan Catch-All is the perfect filter-drier for heat pumps. Ample water capacity . . . unexcelled in acid removal . . . with the famous molded porous core that retains those extra fine particles which cause abrasive damage or troublesome leakage. Only Sporlan Catch-Alls give you really clean, really dry, acid free refrigeration systems.

With a Sporlan See•All you can check the refrigerant in a heat pump system at a glance, because it's the moisture and liquid indicator with the single dot that shows how dry the refrigerant is . . . and the full view sight glass that lets you see if the system is fully charged.

Contact us today for additional engineering data

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS 17, MISSOURI
EXPORT DEPARTMENT, 85 BROAD STREET, NEW YORK 4, N. Y.

ADJUSTED TO MAXIMUM PITCH DIAMETER
ADJUSTED TO MINIMUM PITCH DIAMETER
"SVS"

WOOD'S NEW "SVS" DRIVES
WON'T FREEZE OR STICK...
NO LUBRICATION IS NEEDED

. . . because Wood's "SVS" Variable Speed Sheaves have positive *locking collars* which securely clamp sheave parts into place, eliminating fretting corrosion and freezing as well as the need for lubrication.

WOOD'S "SVS" DRIVES ARE
IN CAPACITIES FROM 1

Wood's stationary control, variable speed drives, including SVS types, are available in capacities from fractional to over 300 hp using conventional v-belts. Wide range VPS types are available in capacities from 1 to 20 hp.

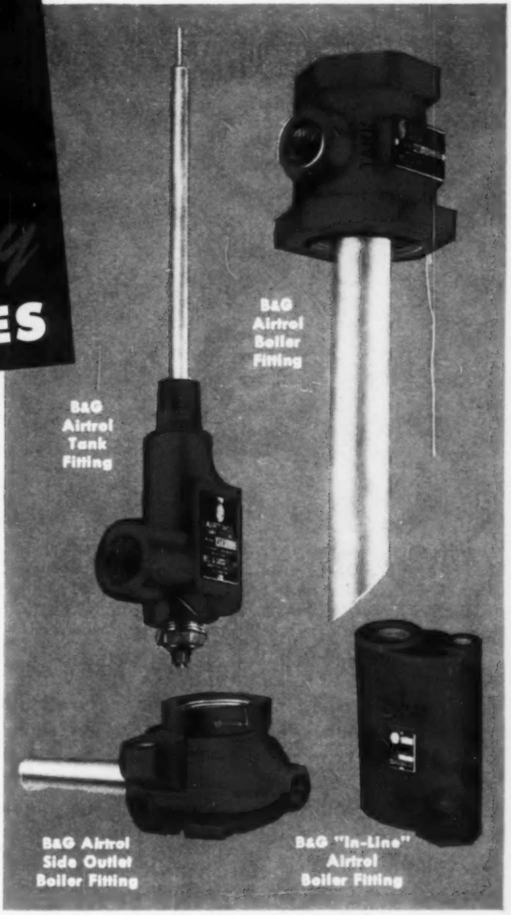
Write for BULLETIN 6102.

T. B. WOOD'S SONS COMPANY · CHAMBERSBURG, PENNSYLVANIA
ATLANTA · CAMBRIDGE · CHICAGO · CLEVELAND · DALLAS

Wood's

SVS/161

B&G
AIRTROL® SYSTEM
...THE *Only* *Guaranteed Way* TO END AIR TROUBLES


B&G Airtrol Boiler Fitting
B&G Airtrol Tank Fitting
B&G Airtrol Side Outlet Boiler Fitting
B&G "In-Line" Airtrol Boiler Fitting

In thousands of hot water heating systems, the B&G Airtrol System is providing a *guaranteed* service in curing air troubles. This patented B&G equipment prevents air-bound radiation, waterlogged compression tanks, gurgling pipes... ends profitless call-backs. *It eliminates the need for automatic air vents!*

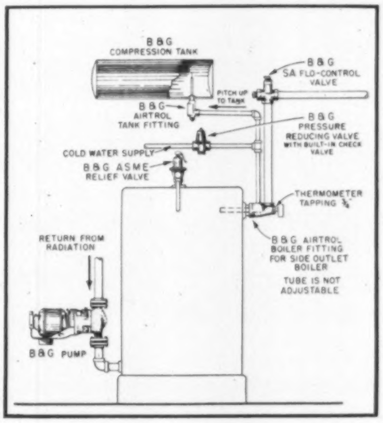
The B&G Airtrol System is simplicity itself. It consists of two easily installed parts—the Boiler Fitting and the Tank Fitting. Their combined function is to trap air in the compression tank and prevent its return to the boiler, piping and heat distributing units. All air bubbles are caught where they form—*in the boiler!*

Any forced hot water system, *regardless of size*, can be equipped with a B&G Airtrol System.

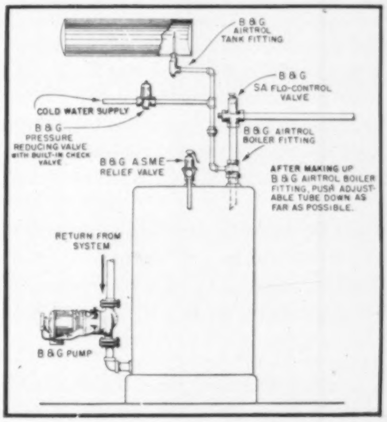
For full information on the only *guaranteed* method of controlling air in hot water systems, send for Bulletin HM-456.

GUARANTEE!

B&G Airtrol® Systems are guaranteed to prevent the accumulation of air in heating units, and prevent noises caused by entrained air in piping. In case of failure of any B&G Airtrol System (within the U.S.A.) to operate correctly, when installed in accordance with our published instructions, we will provide, free of charge, the services of a factory-trained engineer, who will supervise changes required to provide satisfactory results.


B&G COMPRESSION TANK
B&G SA FLO-CONTROL VALVE
PITCH UP TO TANK
B&G AIRTROL TANK FITTING
B&G PRESSURE REDUCING VALVE WITH BUILT-IN CHECK VALVE
COLD WATER SUPPLY
B&G ASME RELIEF VALVE
THERMOMETER TAPPING ¾"
RETURN FROM RADIATION
B&G AIRTROL BOILER FITTING FOR SIDE OUTLET BOILER
TUBE IS NOT ADJUSTABLE
B&G PUMP

Installation of B&G Airtrol System on side outlet boiler


B&G AIRTROL TANK FITTING
B&G SA FLO-CONTROL VALVE
COLD WATER SUPPLY
B&G PRESSURE REDUCING VALVE WITH BUILT-IN CHECK VALVE
B&G AIRTROL BOILER FITTING
B&G ASME RELIEF VALVE
AFTER MAKING UP B&G AIRTROL BOILER FITTING, PUSH ADJUSTABLE TUBE DOWN AS FAR AS POSSIBLE.
RETURN FROM SYSTEM
B&G PUMP

B&G Airtrol System installed on top outlet boiler

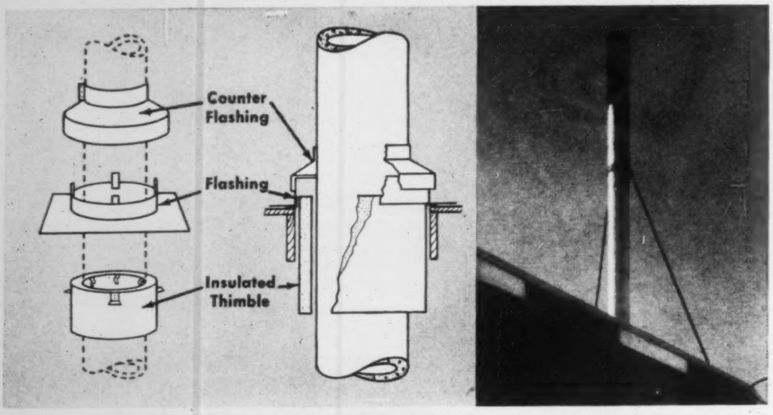
The world's most complete line of Hydronic equipment

BELL & GOSSETT
COMPANY
Dept. GW-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

FLINTKOTE® VAN-PACKER®
Refractory
Industrial Stacks

Solving Industrial Stack Problems

New insulated thimble simplifies the design of Van-Packer stack installation



Details of flashing assembly for Underwriters' Laboratories listed installation of Van-Packer Model HT Industrial Stack. Insulated thimble installs at zero-inches clearance to combustibles at roof opening. In sizes for 8 Van-Packer diameters.

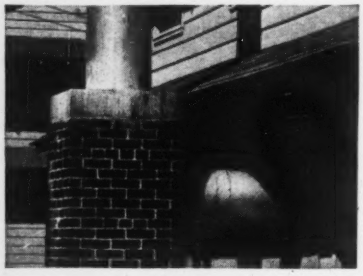
Underwriters' Laboratories, Inc.
®
INSPECTED
Van-Packer Model HT Smokestack

A new insulated thimble and new flashing and counter flashing for Van-Packer factory-built refractory industrial stacks now let you design indoor installations with far less clearance to combustibles than previously required at the roof for a UL-listed installation.

The new components have earned a new Underwriters' Laboratories listing for the Van-Packer Model HT stack — the only UL-listed stack for commercial and industrial incinerators, boilers and furnaces. The insulated thimble installs at zero-inches clearance to combustibles, reducing actual clearance between the stack section and combustible roof from the 18" previously required by Underwriters' Laboratories to 3 inches. In non-combustible construction the thimble is not required because only a 4" clearance is necessary.

The new insulated thimble, flashing and counter flashing are available in appropriate sizes for each of the eight inner diameters in which the Van-Packer stack is offered: 10, 12, 15, 18, 21, 24, 30 and 36 inches. The new components may also be used with the Van-Packer Model BF Stack (not UL-listed). Both models are factory-built in 3-foot cylindrical refractory sections encased in aluminized steel. They can be installed inside or outside on concrete or brick pier foundations, or they can be floor-supported, wall-supported, or superimposed directly on the incinerator or boiler. Van-Packer stacks cost about the same as steel stacks for comparable applications, yet outlast steel an average of three times. The stack provides high draft and requires no painting.

Van-Packer stack section makes ideal breeching for any stack



There's no need to design special breechings for Van-Packer Industrial Stack installations — or for use with any other type of stack. In those cases where the stack is not superimposed directly on the boiler or incinerator, simply specify that the breeching is to be made with a Van-Packer stack section.

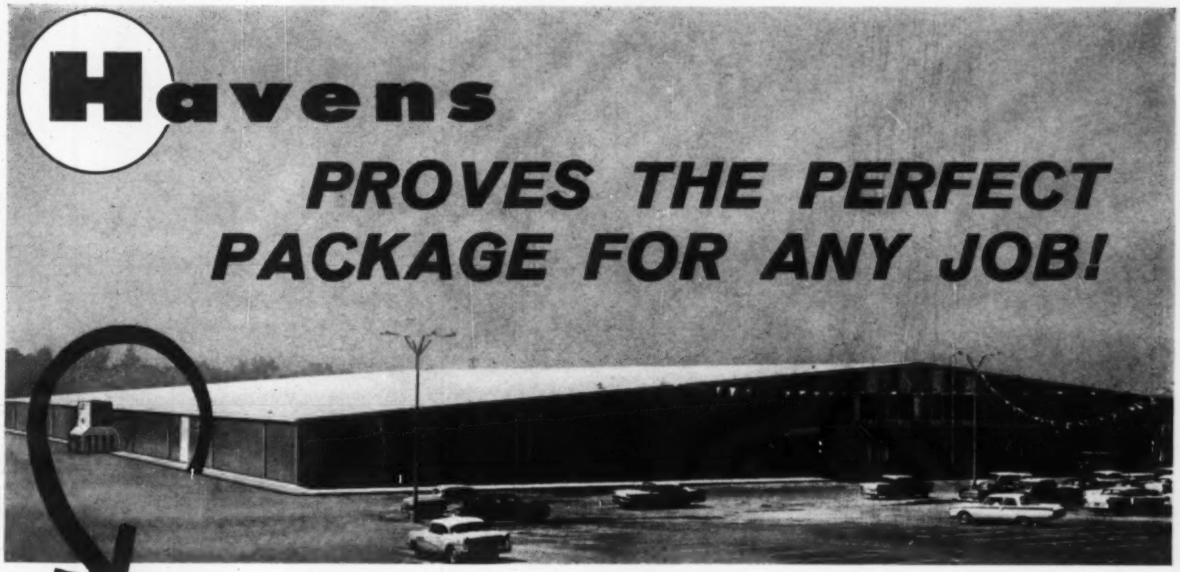
Van-Packer Model HT tee sections have a refractory projection for the breeching connection, with the opening equal to the inner diameter of the stack. A Van-Packer straight section with equal I.D. is easily joined to the projection to complete the breeching. The stack and breeching withstand temperatures up to 1800°F, or up to 2000°F for occasional brief periods of forced firing. Breechings for other Van-Packer stack models may be similarly made.

For full data on Van-Packer Stacks, write for Bulletin IS-49.

For residential use, specify the Van-Packer all-fuel chimney

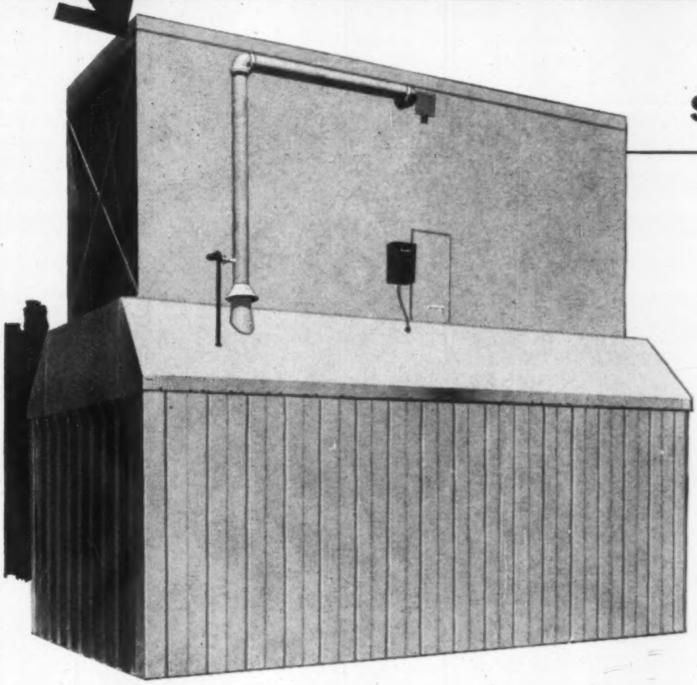
Here's a low-cost, factory-built tile lined residential chimney that's safe and attractive. Specify either metal or asbestos-cement housing with embossed brick design. Choice of four non-fade brick colors: red, white, buff and gray. Factory-built 2-foot flue sections have 5/8-inch fire clay tile liner, 3-inch vermiculite-concrete insulating wall, and asbestos-cement outer jacket. Van-Packer chimney is UL-listed for all fuels, is safe for incinerators. Write for Bulletin RS-1.

FLINTKOTE® VAN-PACKER®
The Flintkote Company
Manufacturers of Diversified Products for Home and Industry
30 Rockefeller Plaza, New York 20, N. Y. Phone: PLaza 7-5500
In the West: Pioneer Division, The Flintkote Company, P. O. Box 2218, Terminal Annex, Los Angeles, Calif.
In Toronto, Ontario: The Flintkote Company of Canada, Ltd.



Havens

PROVES THE PERFECT PACKAGE FOR ANY JOB!



UNIQUE 3 PACKAGE
SIDE BUILDING INSTALLATION
at the NEW

HOME OWNERS MART

IN KANSAS CITY

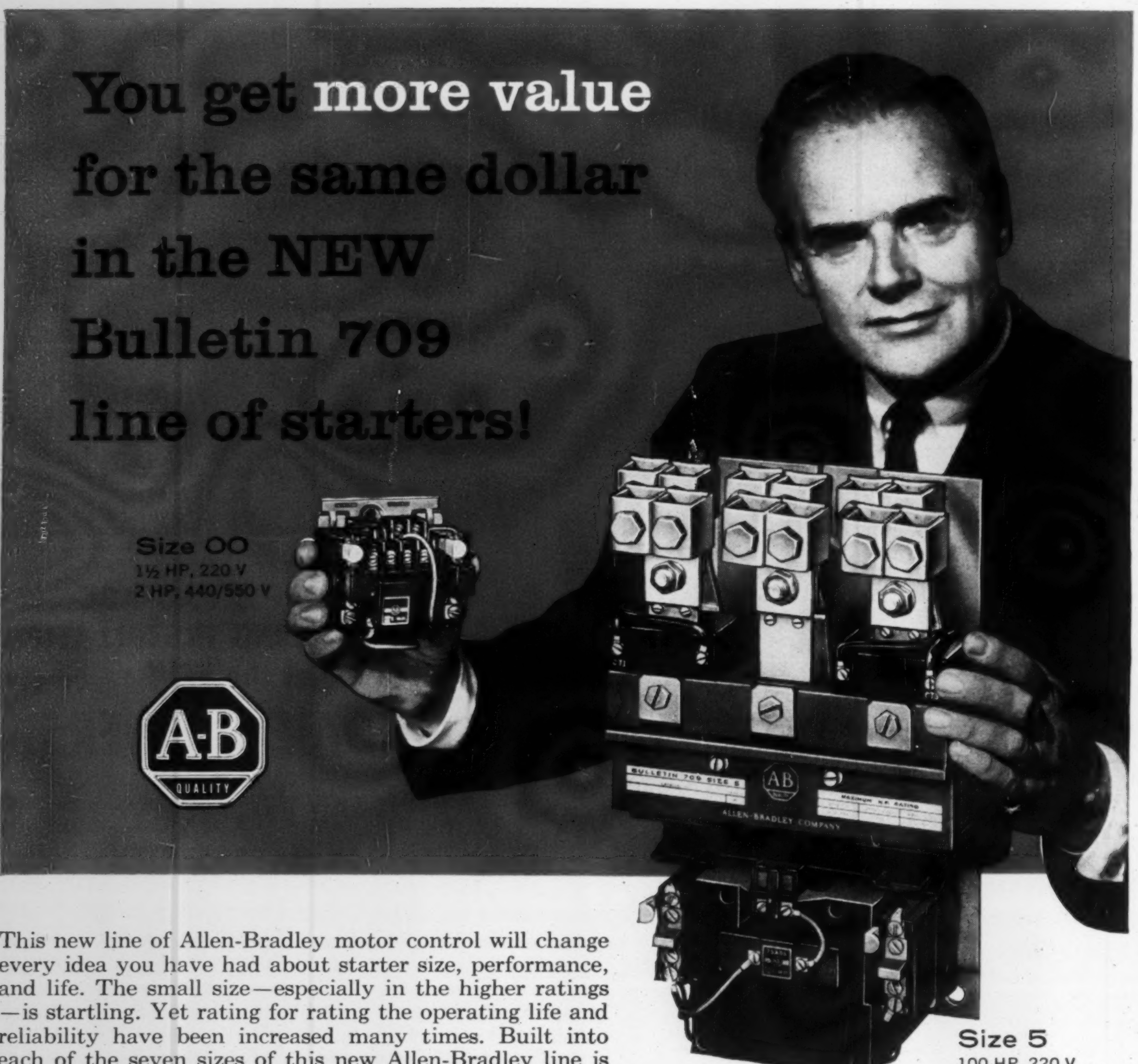
133,000 square feet under roof at the New Home Owners Mart in Kansas City, Missouri. This low lengthy roof has no towers or air conditioning units on it. Three 125-ton Havens' towers are installed beside the building. Each Havens' tower forms the roof of a steel structure enclosed with curtain wall which serves as an equipment room containing a 125-ton compressor and related equipment.

Havens Performance Proven Cooling Towers

Havens, the name to remember in packaged cooling towers, offers more versatility for air conditioning, refrigeration and industrial process. The complete line of packaged towers and multiples from 5 thru 600 tons. Be sure to get the tower that fits the structure... the HAVENS COOLING TOWER.

Havens COOLING TOWERS
DIVISION OF HAVENS STRUCTURAL STEEL CO.
1713 CRYSTAL AVE., KANSAS CITY 26, MISSOURI

You get more value for the same dollar in the NEW Bulletin 709 line of starters!



Size 5
100 HP, 220 V
200 HP, 440/550 V

This new line of Allen-Bradley motor control will change every idea you have had about starter size, performance, and life. The small size—especially in the higher ratings—is startling. Yet rating for rating the operating life and reliability have been increased many times. Built into each of the seven sizes of this new Allen-Bradley line is an ability to interrupt tremendous currents and to operate year in and year out for many millions of operations without trouble or maintenance.

The new Bulletin 709 starters are just as advanced in appearance as they are in performance. All seven sizes have an aristocratic styling and a distinctive family likeness. Brooks Stevens, famous industrial designer, has given the enclosures such an attractive, modern style that these new starters will prove a distinct sales asset on any machine or installation.

Why not write today for more information on this revolutionary new line of Allen-Bradley Bulletin 709 *quality* across-the-line motor starters?

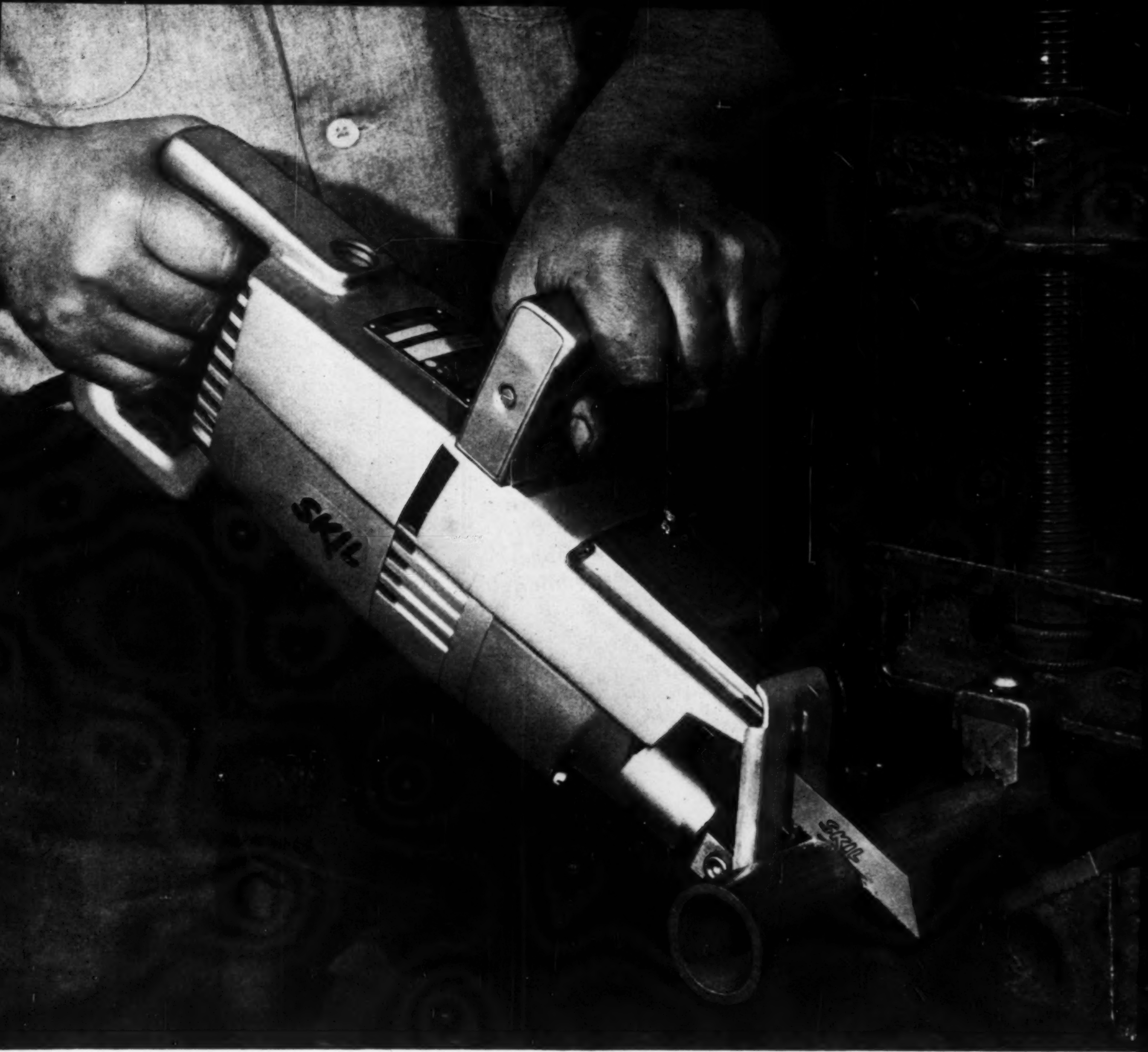
Note the compactness of both the smallest and largest starter in the new Bulletin 709 line. Ratings up to 100 hp, 220 v; 200 hp, 440-550 v.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

QUALITY MOTOR CONTROL



Cuts 2-inch cast iron pipe in less than 2 minutes!

New Skil Model 701 . . . world's only portable electric, metal-cutting hacksaw!

This all-new, Skil Model 701 Recipro Saw—companion to the Model 700 all-purpose Recipro Saw—is the only portable power saw made specifically for fast cutting of any metal or highly abrasive material, including stainless, cast iron, metal lath and building tile.

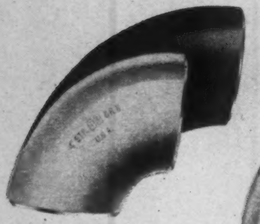
It has 2 speeds; 1000 and 1400 strokes per minute for extremely fast cutting of different gauges and densities of metals and with longest blade life. Standard equipment includes steel carrying case and 4 assorted blades.

Ask your Skil distributor to demonstrate either or both Recipro Saw models. Look under "Tools-Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 134K, 5033 Elston Ave., Chicago 30, Ill.

Improved All-Purpose Model 700! Newest version of world's first 2-speed reciprocating saw. 2600 s.p.m. speed for metal; 3500 s.p.m. speed for wood, compositions, plastic.

SKIL . . . and SKILSAW POWER TOOLS

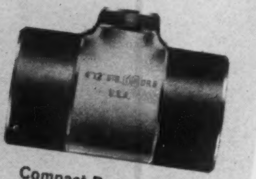
Now



Compact 90° Elbow versus conventional long radius elbow*

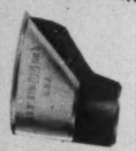
Compact 45° Elbow versus conventional 45° elbow†

Compact Straight Tee versus conventional



Compact Reducing Tee versus conventional

Compact Concentric Reducer versus conventional



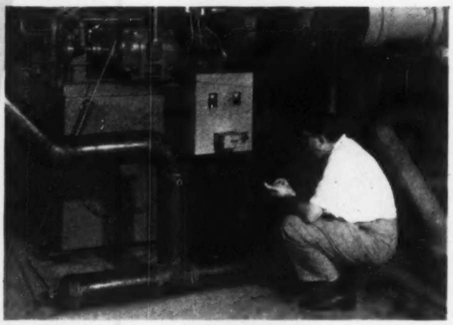
Compact Eccentric Reducer versus conventional

Compact Welding Cap versus conventional

Note these actual photos showing dimensional differences between Compact Fittings and corresponding conventional fittings.

*The Compact 90° elbow is contrasted with a conventional long radius elbow which is by far the most commonly used type. Of course the dimensions of the Compact 90° elbow are the same as those of regular short radius Taylor Forge WeldELLS.

†The 45° conventional elbow has heretofore been obtainable only in the long radius pattern shown in the comparison.



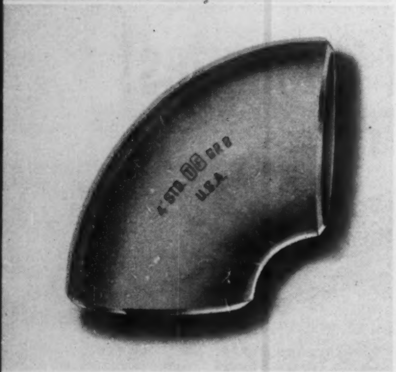
Tests prove rugged strength

Photograph shows a test that has proved the rugged strength of Compact Line Fittings. The test unit was fabricated from 4" and 6" Standard Thickness (Schedule 40) Grade B pipe and includes a 6" x 6" x 6" Tee, a 6" 90° Elbow, a 6" 45° Elbow and a 6" x 4" Concentric Reducer.

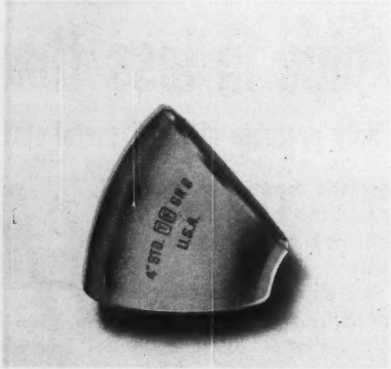
In testing, a mean pressure of 875 psig (five times WOG rating) was established as basic pressure. Cyclic pressure variation was from 50% under to 50% over this pressure—in other words, from 437 psig to 1312 psig. The assembly was then subjected to 36,500 of these pressure cycles—the equivalent of one cycle per day for *100 years!*

Upon completion of the cyclic testing, the unit was hydrostatically burst, the break occurring, as it theoretically should, in the crotch of the tee and extending into the adjacent run and branch pipes. Moreover, the unit had to be brought to a pressure of 5200 psig before bursting, yet the theoretical bursting pressure of 6" pipe is only 5080 psig. After 36,500 pressure cycles this result is rather startling.

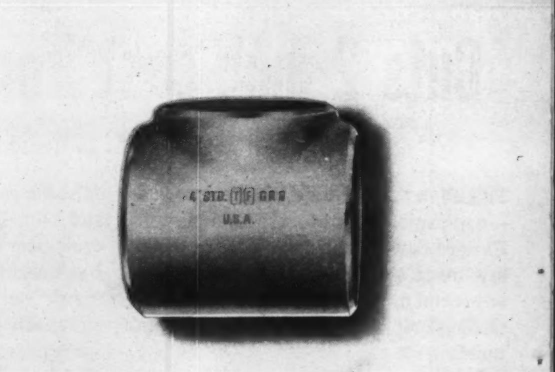
90° ELBOWS



45° ELBOWS



STRAIGHT TEES



it's the New TAYLOR FORGE

there IS a way

to cut heating/cooling piping costs and still have a piping job you can be proud of

Yes, the new Taylor Forge Compact Line of welding fittings really does reduce piping costs. First, because the simplified designs and reduced dimensions permit major manufacturing economies. Second, because all other incidental costs—shipping, storage, trucking, on-the-job handling—are also less than with conventional fittings.

Take the 4″ size for example: A "set" of Compact Fittings consisting of a 90° and 45° elbow, straight tee, cap, 4″ x 2″ tee, 4″ x 2″ concentric reducer and 4″ x 2″ eccentric reducer exactly as illustrated here, weighs little more than half as much as corresponding conventional fittings. And remember, this weight savings is purely the result of designing and dimensioning functionally for economy.

Taylor Forge Compact Line Fittings give you a piping job you can be proud of, too. Proud of its trim functional appearance. Proud of its rugged strength and complete dependability—well supported by the test described on the opposite page.

Compact Line Fittings are of seamless construction using Grade B carbon steel. The line includes 90° and 45° elbows, straight and reducing tees, concentric and eccentric reducers and caps in sizes 2″, 2½″, 3″, 4″, 5″ and 6″; reducing tees and reducers in intermediate iron pipe sizes down to one-half of the nominal run or large end size. They are manufactured to the same high standards as other Taylor Forge products for piping and pressure vessel construction. All have complete stamped-in identification markings as shown. For protection, identification, and pleasing appearance, they are painted orange with non-toxic corrosion resistant paint.

Compact line fittings are carried in stock by Taylor Forge Distributors in all important trading centers. The whole story is in Bulletin 619. *Ask for it.*

American-made Welding Fittings

Designed and manufactured for utmost economy. No frills; just the solid value you would expect from **TAYLOR FORGE.**

T F

TRADITIONALLY DEPENDABLE

Taylor Forge & Pipe Works

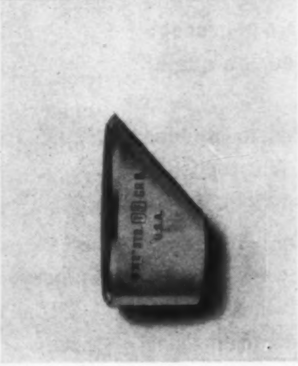
General Offices and Works: P. O. Box 485,
Chicago 90, Illinois
Plants: Carnegie, Pa.; Somerville, N.J.; Gary, Ind.;
Houston, Texas; Fontana, Calif.; Hamilton, Ont., Canada
District Sales Offices: New York, Philadelphia,
Pittsburgh, Atlanta, Chicago, Houston, Tulsa, Los Angeles,
San Francisco, Seattle, Hamilton, Calgary, Montreal

REDUCING TEES

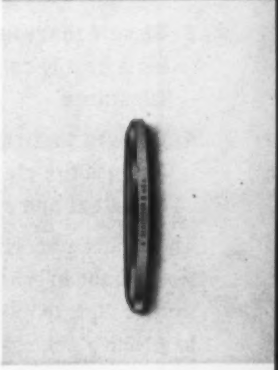
4"X2" STD. TF GR B
U.S.A.

CONCENTRIC REDUCERS

ECCENTRIC REDUCERS

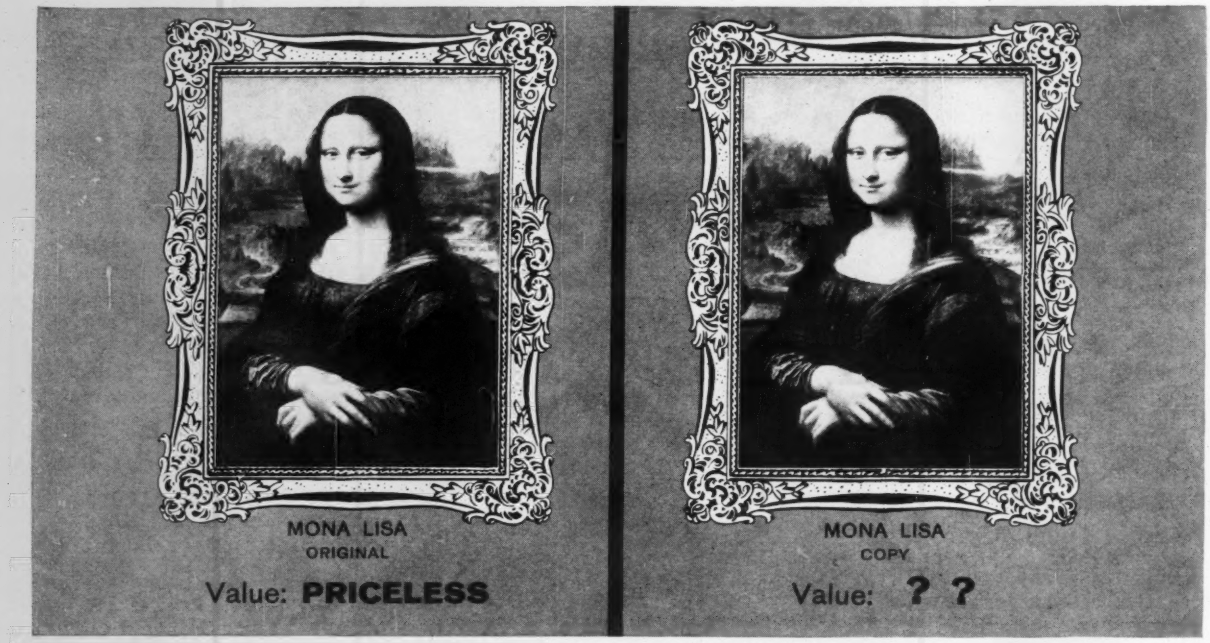


WELDING CAPS



COMPACT LINE *of Welding Fittings*

When buying ART...



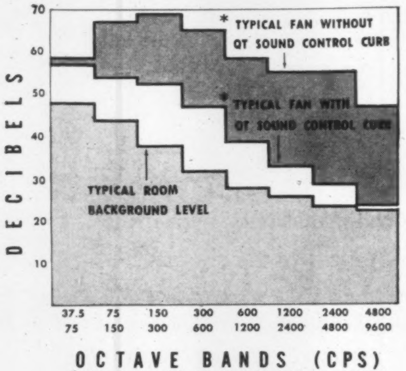
or selecting a SOUND CONTROL CURB it pays to be SURE!

1. **Be sure that performance data has been authenticated**
2. **Be sure that the design is original and not bootlegged**
3. **Be sure that you are not accepting a hastily copied, low quality substitute**
4. **Be sure that rights to produce and use are clearly established by patent and copyright laws**

The famous admonition, *caveat emptor* ("let the buyer beware"), is well worth calling to mind when it comes to selecting a sound attenuating curb for your power exhausters. Since performance cannot be judged visually, extreme caution is your best insurance against disappointing results.

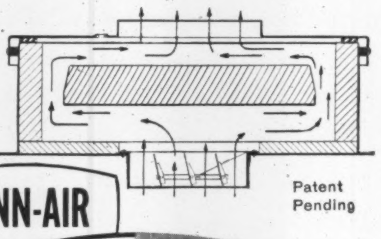
Consider these facts: Jenn-Air's QT Sound Control Curb is the first curb that *effectively* reduces fan noise. This major breakthrough in design provides twice as much attenuation as any previous so-called sound curb. The QT Sound Control Curb reduces exhauster sound power at inlet by 90% . . . with only a 10% drop in air moving capacity! These are actual performance figures—verified by independent laboratory tests.

Get all the facts before you specify—you'll find the Jenn-Air QT Sound Control Curb to be the genuine article. Write for Bulletin 601-SC.



*MODEL 100 CR, ⅓ HP, 1725 RPM MOTOR

EXCLUSIVE JENN-AIR DESIGN
Cross Section QT Sound Control Curb



Patent
Pending

JENN-AIR

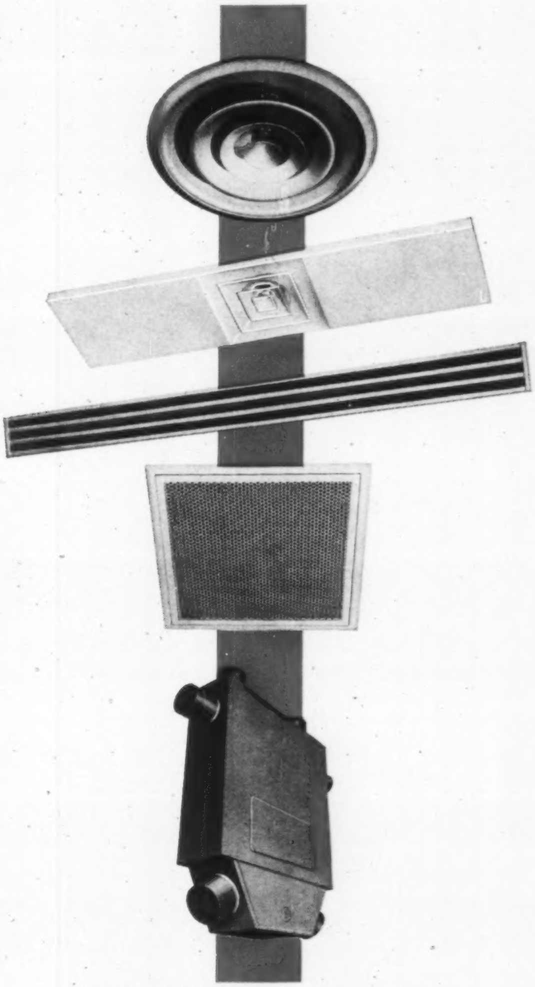
QT
SOUND CONTROL CURB

JENN-AIR PRODUCTS COMPANY, INC. • 1102 STADIUM DRIVE • INDIANAPOLIS 7, INDIANA

When
ANEMOSTAT
is in sight
the system is
RIGHT

Anemostat offers a complete range of air diffusion equipment for every engineering and architectural need. You can specify exactly the unit you need for conventional or high-velocity systems. In fact, when Anemostat air diffusers are in sight, you can be sure the system is right.

As a result of scientific research and development — plus experience gained in tens of thousands of installations—we have consistently improved the quality and performance of Anemostat products. There is still no "or equal" for ANEMOSTAT.



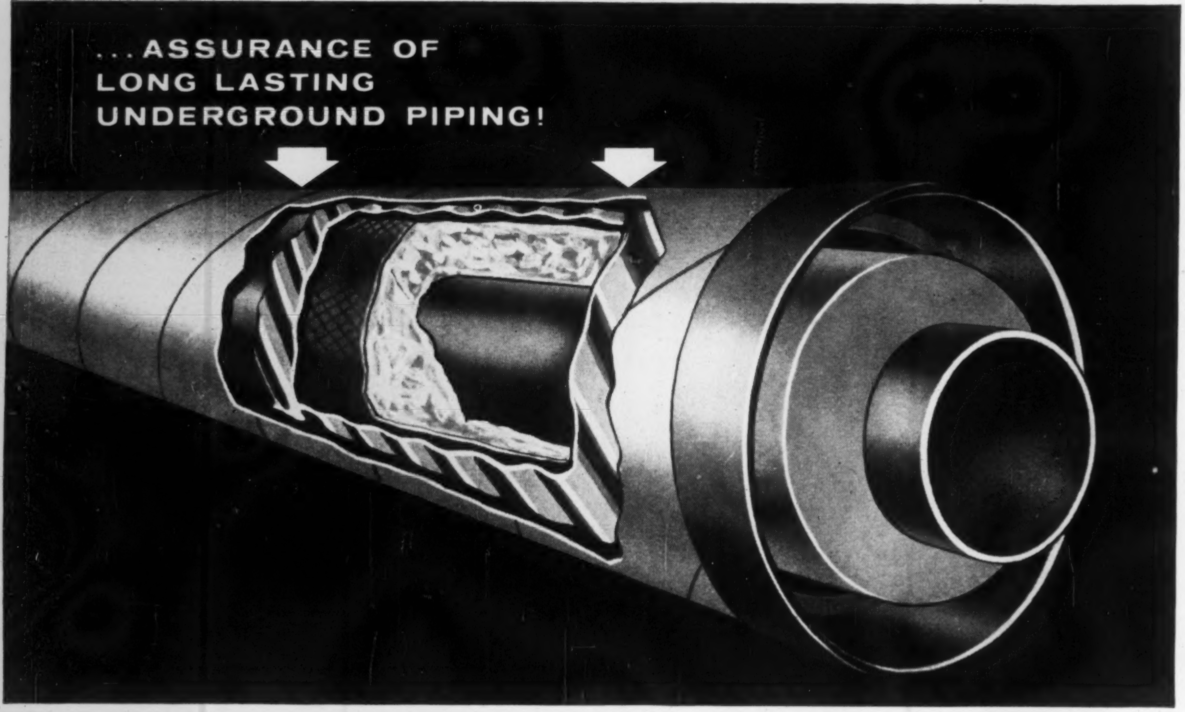
ANEMOSTAT®

ANEMOSTAT CORPORATION OF AMERICA
A Subsidiary of **DYNAMICS CORPORATION OF AMERICA**

Factory and General Offices: 888 North Keyser Avenue, Scranton, Pa.
National Sales Office: 25 West 43rd Street, New York 36, N. Y.
Representatives in Principal Cities

AC-1384

GALVANIZING



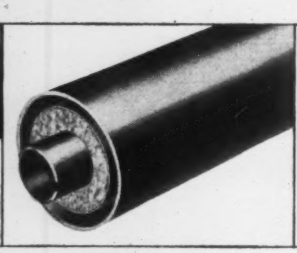
Hot-dip galvanizing of the Hel-cor Conduit in a Ric-wiL system offers the finest in corrosion protection. The Zinc actually alloys to the steel and becomes an integral part of the conduit . . . not just a surface coating. The Automobile Industry has announced through The American Zinc Institute that after testing 450 coatings, Zinc was best from the standpoint of resistance to corrosion.

The illustrated catalog offers a wealth of information on types of systems, engineering, specifications, and installation methods . . . write today for your copy. . .

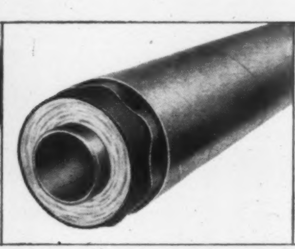
RIC-WIL
BARBERTON, OHIO

OTHER AVAILABLE
RIC-WIL SYSTEMS...

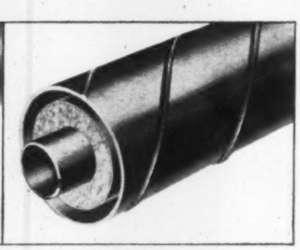
UNILINE



CAST IRON



LO-TEMP



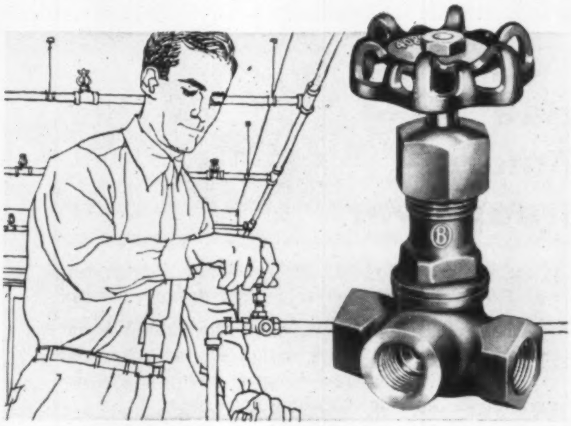
IMPERIAL

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

RIC-WIL PREFABRICATED INSULATED PIPING SYSTEMS

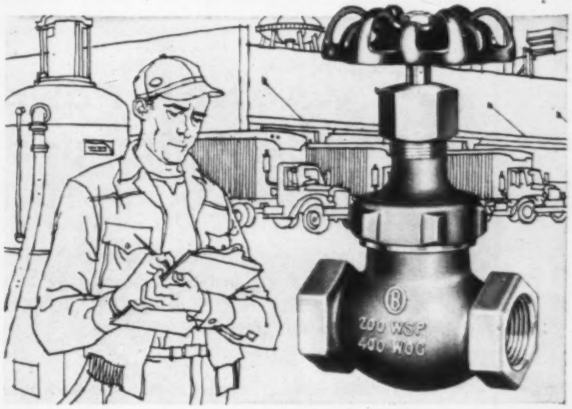
CENTRAL OFFICE: RIC-WIL INCORPORATED, BARBERTON, OHIO
WESTERN STATES: RIC-WIL INCORPORATED, WESTERN DIVISION, NEWARK, CALIFORNIA
IN CANADA: THE RIC-WIL COMPANY OF CANADA LTD.

O-B Valves have Teflon packing that endures...



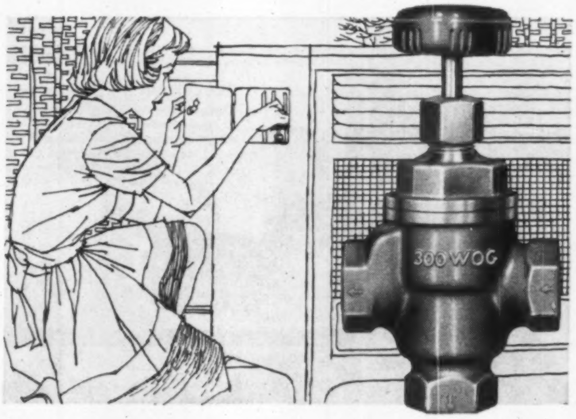
... in sprinkler systems

This O-B No. 408 side-outlet needle valve is ideal for sprinkler systems and in other piping where both "tee" and needle point are needed for effective control. Pressure gauge is often threaded on side outlet. Its tough Teflon-impregnated packing gives long-lasting corrosion resistance.



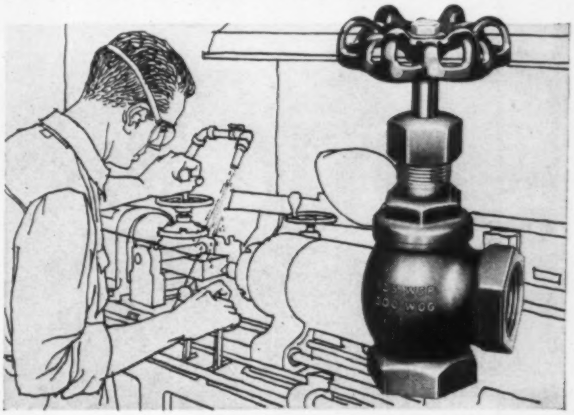
... in gasoline pipelines

Tight shutoff in gasoline and other services makes O-B globe valves (like plug-type No. 1401) most effective—particularly where continual throttling is necessary. The O-B Teflon-impregnated packing safeguards valve operation and helps avert the hazards of corrosion in piping gasoline.



... in room-controlled units

Controlling the output of individual room units in central heating-and-cooling systems calls for this 3-way double-seated by-pass valve. It permits varying output of water to regulate temperature of rooms. Continual on-and-off operation is safeguarded by smooth, flexible, durable Teflon packing.



... in coolant supply lines

Their Teflon packing—impervious to the ravages of oil and other processing fluids—makes O-B globe and angle valves ideally suited for coolant supply. O-B bronze valves such as No. 102 pictured provide tight shutoff of all oil grades. Its semi-plug type brass disc also promotes a tight seal.

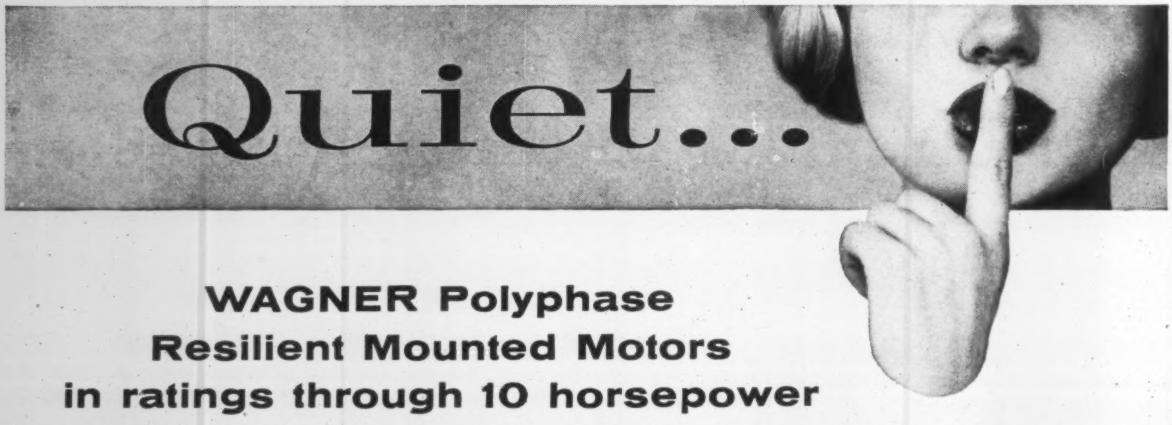
10064-Vu

O-B valves—first to use long-wearing Teflon packings throughout the line—offer many feature-advantages in sizes from ⅛" to 3". You profit most when you standardize on the complete O-B bronze valve line. Write for latest catalog information.

OHIO BRASS COMPANY • Mansfield, Ohio

HOLAN
Ohio Brass

Ask your distributor for the valve in the orange-and-black box



WAGNER Polyphase Resilient Mounted Motors in ratings through 10 horsepower

Quiet, vibration-free performance is essential when motors are installed in areas where noise must be held to a minimum . . . in hospitals, churches, schools, office buildings, restaurants and similar locations where quiet is needed or wanted.

Such installations have created a need for larger polyphase motors that whisper while they work. Wagner has met this need by expanding its line of polyphase resilient mounted motors to include standard ratings through 10 hp.

You certainly have applications that call for a smooth running motor, cushioned by resilient mountings. To make sure they're quiet, specify Wagner Polyphase Resilient Mounted Motors. Only Wagner can provide an entire range of ratings through 10 hp.

Constant research and development have kept Wagner up front in electric motor design for more than 65 years . . . made the name Wagner one you can depend on in choosing electric motor drives.

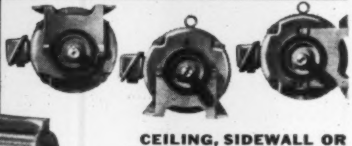
Your nearby Wagner Sales Engineer can help you select the right motor to meet your requirements. There are Wagner branch offices in 32 principal cities.

Wagner Electric Corporation
6370 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

WM60-14

SLEEVE OR BALL BEARING

These motors are furnished with quiet running steel-backed babbitt-lined sleeve bearings of high load carrying capacity. Ball bearings can be supplied when desired.



CEILING, SIDEWALL OR HORIZONTAL MOUNTING

You can mount these motors on walls or ceilings by rotating the cradle base 90° or 180°. Motor stays dripproof.

NEOPRENE CUSHIONING RING

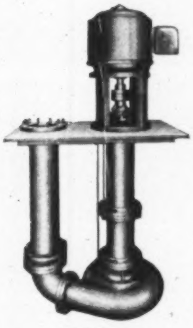
Annular mountings, of oil-resistant neoprene bonded to steel rings, cushion the motor in its cradle base to absorb the small amount of vibration that remains in the most carefully balanced motor.

"from Chicago" A complete line of Vertical Enclosed Shaft Non-Clog Pumps

FOR HEAVY DUTY PUMPING OF SEWAGE, SUMP AND STORM WATER, CONTAINING SOLIDS

Chicago pumps are durably built units featuring micrometer ball bearing adjustment of rotating elements, tongue and groove registering, and oversized bearings. The Chicago two port non-clog impeller remains in natural hydraulic balance thruout the pumping cycle. All impellers are also dynamically balanced.

Manufactured by Chicago Pump, with over 52 years of unequaled experience in the design and manufacturing of non-clog pumps. Backed by a reputation for excellence in design and outstanding service to its thousands of satisfied customers. Write for Bulletin 124-G.



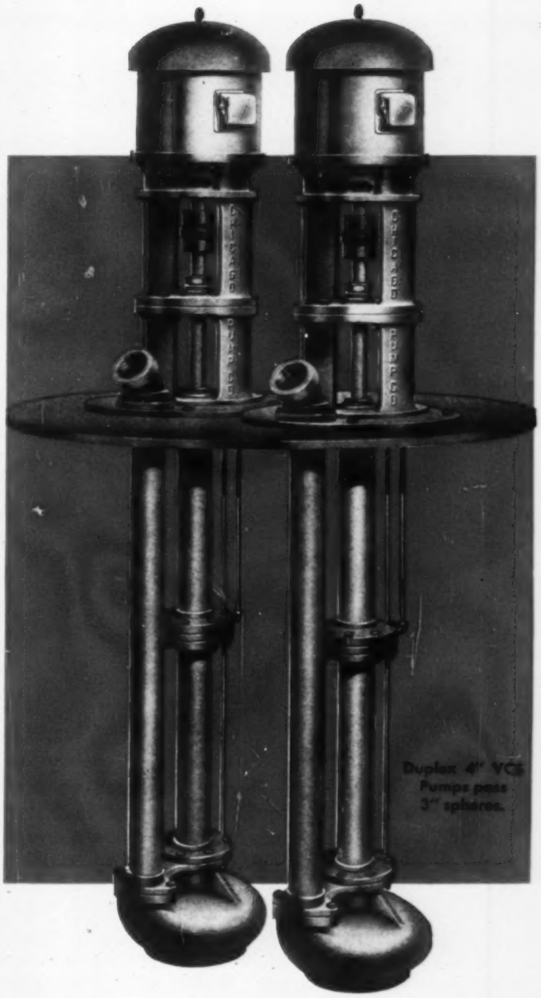
10" VCS
Pumps pass
5" spheres.

HIGHER CAPACITY VCS PUMPS

Pumps range from 4" thru 10" discharge size available for single or duplex installation. All pumps incorporate the same high grade materials and machined tolerances for extended life.

EXCLUSIVE SEALTRODE

"Sealtrode", sealed electrode floatless pump controller is a dependable control for any installation. Electrodes cannot become coated or insulated with grease, oil, soap or solids. Elements never corrode as they are sealed from the liquid being pumped.



Duplex 4" VCS
Pumps pass
3" spheres.

Capacities: 50 to 5000 GPM
Heads to 105 feet.

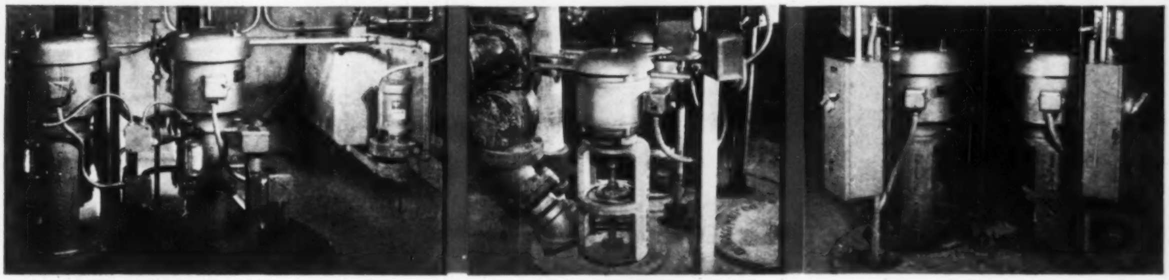
fmc CORPORATION ®

HYDRODYNAMICS DIVISION

CHICAGO PUMP

622C Diversey Parkway • Chicago 14, Illinois

© 1961—CP-FMC



Short cut to improved performance:

Flexpipe® CONNECTORS

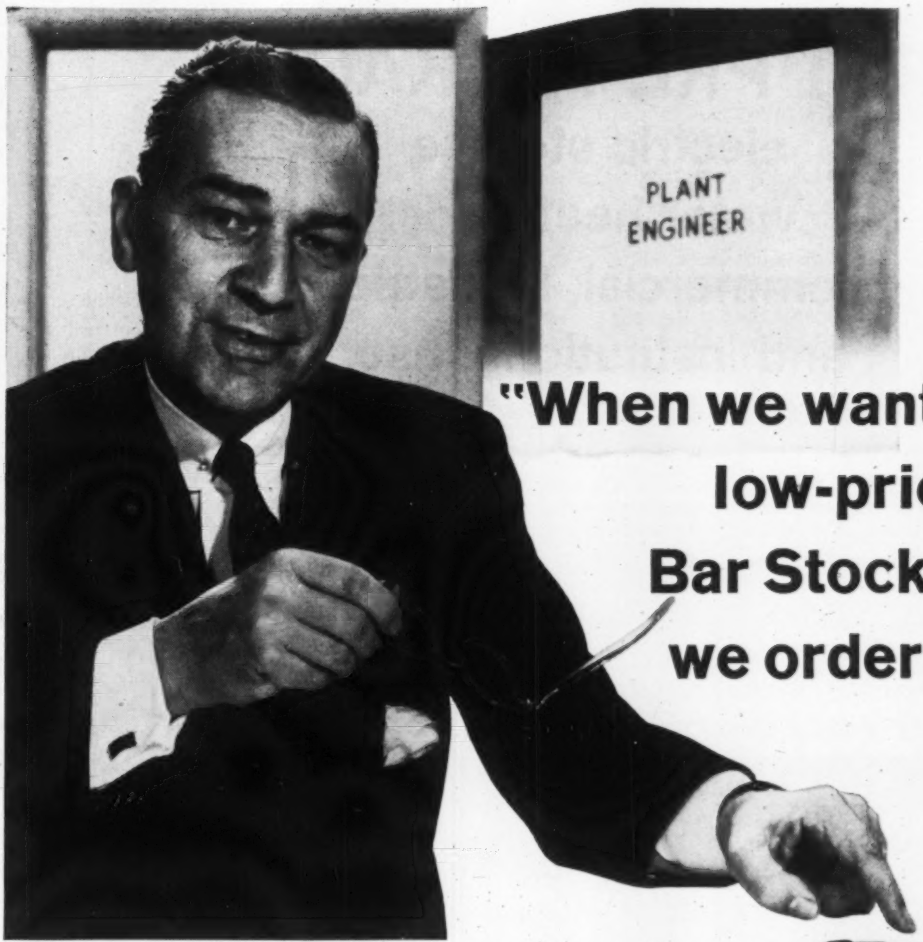
ANACONDA METAL
PAT. 2712

Anaconda Flexpipe is a sure shortcut to more dependable heating systems. Its ease of installation and flexibility eliminate a patchwork of elbows, couplings, short runs of pipe. And Flexpipe is easy to work with even in confined areas. Equally important, Flexpipe is designed to take up movement caused by expansion and contraction over a wide variation in temperatures . . . compensate for misalignment . . . and, consequently, deliver far longer service than conventional systems.

Flexpipe core is available in bronze, hot-dipped galvanized steel, or stainless steel. Sizes range from ¼″ through 30″ I.D.

WHERE TO BUY: Leading wholesale distributors can provide information about Flexpipe in standard sizes. For name and address of the distributor serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, Anaconda American Brass Company, P.O. Box 791, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-952

ANACONDA®
METAL HOSE DIVISION



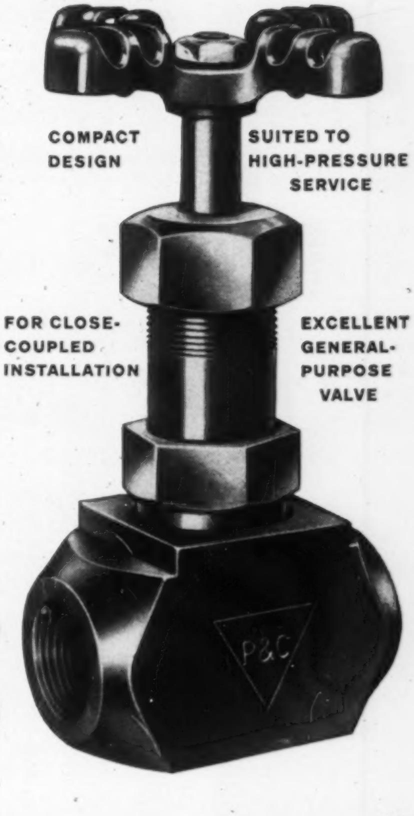
"When we want rugged, low-priced Bar Stock Valves we order R-P&C"

"For a really versatile, **all-purpose** valve, we've found there's none better than R-P&C bar stock valves. Designed and built **for close control service,** the construction of these valves makes them well suited to many general purpose applications as well. For example, the **compactness** of R-P&C bar stock valves is particularly advantageous for close-coupled installations in instrument lines or on panel boards and for pressures up to 10,000 lbs. in steel."

These valves are available in a wide variety of materials to withstand extremely high temperatures and pressures. But best of all, R-P&C bar stock valves are economically priced. This is made possible through special techniques developed by R-P&C.

We highly recommend R-P&C bar stock valves for meter, gauge, sampling, or test valves on equipment requiring a reliable compact valve that can withstand high pressure service.

Contact your R-P&C distributor for full details about bar stock valves in bronze, carbon and stainless steels plus the complete line of R-P&C gate, globe and angle valves in all standard materials.


COMPACT DESIGN
SUITED TO HIGH-PRESSURE SERVICE
FOR CLOSE-COUPLED INSTALLATION
EXCELLENT GENERAL-PURPOSE VALVE
P&C

R-P&C VALVES ACCO

R-P&C Valve Division, American Chain & Cable Company, Inc.
Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York,
Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

FIRST PRE-PACKAGED
electric storage water heater for commercial, industrial and institutional use.

The new P-KW is the first electric storage water heater to be offered as a standard package unit. It is shipped fully wired, insulated and factory tested. It requires only electrical and water connections to place in operation.

The new unit is equipped with immersion heater, control thermostat, magnetic contactors, circuit breaker, panel control box, ASME temperature and pressure relief valves, thermometer, pressure gauge, metal jacketed insulation, and integral support skids.

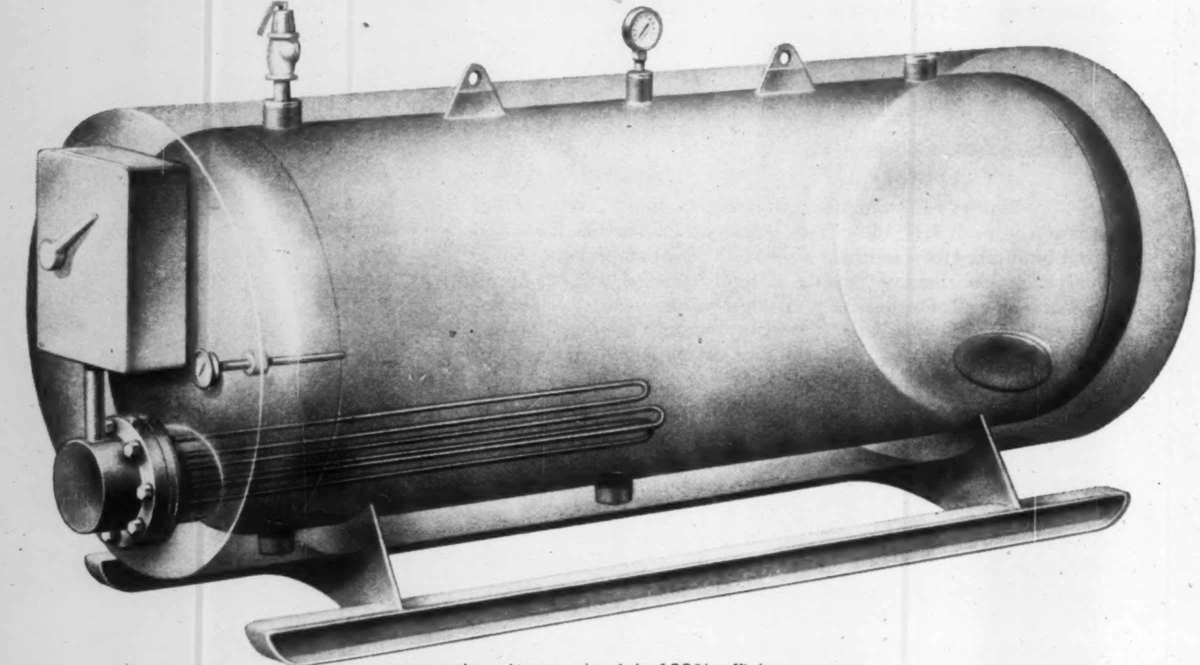
Made by P-K on a custom basis for many years, P-KW Electric Storage Water Heaters are designed and fabricated in accordance with the ASME Code and Federal, State and local regulations.

Components that comprise the electrical system, including wiring, meet the requirements of Nema standards and the National Electrical Code.

The immersion heating elements are operated approximately 10 per cent below their voltage capacity—assuring long, trouble-free service. The thermal conversion approximates 100 per cent efficiency.

Pre-packaged P-KW water heaters can be selected for three working pressures — 100, 125, and 150 psi.

WRITE FOR CATALOG NO. P-KW-1: contains diagrams, specifications, complete engineering and performance data. Address your request to: The Patterson-Kelley Co., Inc., 311 Morgan Avenue, East Stroudsburg, Pa.



- operates at approximately 100% efficiency
- storage capacities from 284 to 1,300 gallons
- recovery capacities from 41 to 410 gph
- horizontal or vertical design
- safe, silent, automatic

Patterson Kelley

POWELL PERFORMANCE PAYS OFF

Any way you look at it, Powell performance really pays off. Take "availability" for instance.

You'll find that Powell makes just about any type of valve you may need—for oil, water, gas, steam, air and corrosive fluid applications. The same holds true for virtually any temperature and pressure. What's more, you'll find Powell valves are available in industry's widest selection of bronze, iron, steel and special alloys—from aluminum to zirconium. (The fact is, Powell pioneered application of special alloys in valve design.)

In short, you'll find Powell performance also includes outstanding availability—of exactly the type valve you need. And, since Powell maintains large stocks both at the factory and key points across the country—you get exactly what you need, when you need it. For further information, contact your nearby Powell Valve distributor or write The Wm. Powell Co., Cincinnati 22, Ohio.

POWELL
175 WOG
200 WOG
MS
POWELL
125S
M.S.
POWELL
125

125-pound All Iron Gate Valve. Outside screw rising stem and yoke. Flanged ends, 2" through 30". Screwed ends, 2" through 8". Iron body bronze mounted valves also available.

175-pound W.O.G. Semi-Steel flanged and Lubricated Plug Valve. Wrench operated. Sizes 1" through 4". Available also with screwed ends. Catalog of complete line on request.

125-pound Iron Body Bronze Mounted Swing Check Valve. Bolted flanged cap. Can be used in either horizontal or vertical position. Sizes, flanged, 2" through 18"; screwed, 2" through 4". Can also be furnished in all iron.

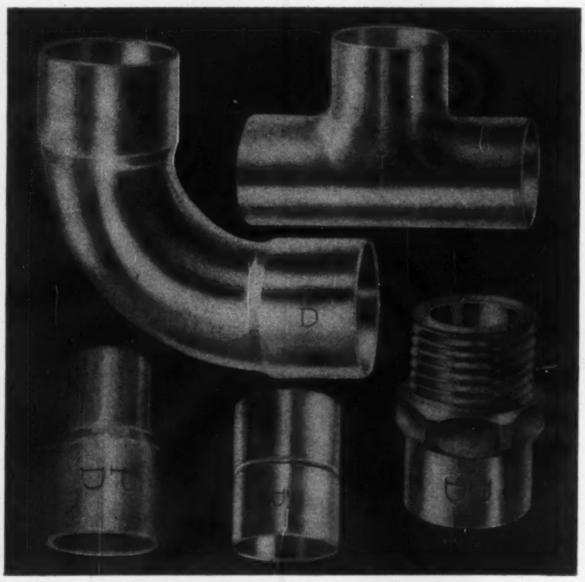
Be sure and visit our Booth No. 133 at the 28th Exposition of Chemical Industries, New York Coliseum, Nov. 27-Dec. 1.

See our catalog in Sweet's

115th year of manufacturing industrial valves for the free world

POWELL DEPENDABLE **VALVES**

THE WM. POWELL COMPANY CINCINNATI 22, OHIO

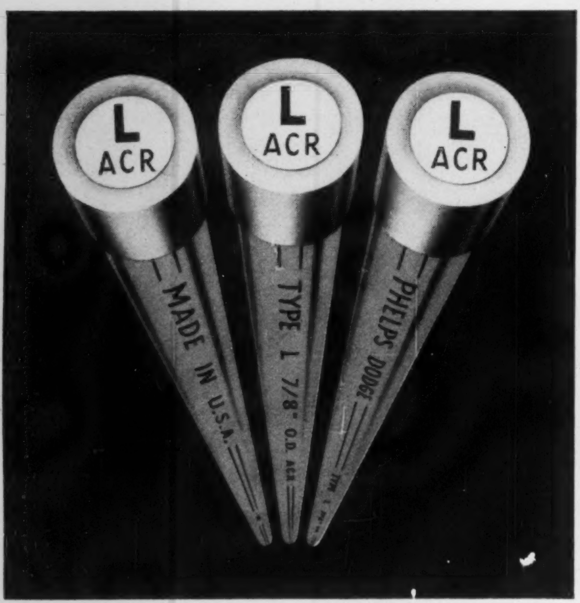


WHY YOU SHOULD SPECIFY

Phelps Dodge

A complete line of Copper Refrigeration and ACR Tube, and Wrot Fittings from one Source!

1 **NEW WROT SOLDER-TYPE FITTINGS.** Phelps Dodge has added a wide range of fittings in sizes from ⅛-inch to 6 inches. All fittings are protectively packaged for factory-clean delivery.


L ACR
L ACR
L ACR
MADE IN U.S.A.
TYPE L 7/8" O.D. ACR
PHELPS DODGE

2 **COLOR-CODED ACR TUBE WITH O.D. MARKINGS.** Phelps Dodge ACR tube is specially cleaned for refrigeration use. Extra-long coded end caps are your assurance of factory-clean tube at job site. Tube is color-coded for fast identification and marked with outside dimension.

PHELPS DODGE
COPPER REFRIGERATION TUBE
DEHYDRATED AND ENDS SEALED
½" O.D. .032
P MINE TO MARKET D
PHELPS DODGE COPPER PRODUCTS CORPORATION
RAHWAY, N.J. YONKERS, N.Y. LOS ANGELES, CAL. SO. BRUNSWICK, N.J. FT. WAYNE, IND.

3 **NEW P-D PAK CARTON.** Reel-type design of convenient new carton allows refrigeration tube to be rolled or paid out quickly on the job. Color-coded tape seals carton for protection, yet opens easily.

Quality tube and fittings sold the quality way—through authorized refrigeration wholesalers!

AIR-CONDITIONING AND REFRIGERATION
A·R·W
WHOLESALERS
ASSOCIATE
MEMBER

PHELPS DODGE COPPER PRODUCTS
CORPORATION
New York, N.Y. • Los Angeles, Calif.

P
MINE TO MARKET
D

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"Open for Discussion"

Some Control Considerations At Plutonium Fuel Facility Lab

THE AUTHORS of *Hood Ventilation in Argonne's Plutonium Fuel Fabrication Facility . . . A Critical Review,* by R. H. Mayfield and H. Bairiot in the September issue have done a fine job of discussing the problems which existed and were eventually resolved during the installation of Facility 350.

The control application required that a differential pressure controller operate at a set point of less than 1 percent of its range and with reproducibility within ± 0.5 percent. This is a very severe specification for a commercial control instrument which is built for extreme flexibility of application in order to be economical. Therefore the fact that industrial type instruments were finally used is not surprising. This does not rule out the possibility of an economical commercial controller doing the job. It, however, would have to be one designed for that specific job. This of course means justifying the design of this new instrument and its manufacture on the basis of market potential.

Meet Quick-Acting Requisite

Butterfly valves with the tight seating feature require a great deal of power to properly force the blade into and out of the seal. This means large operators which require large changes in air volume to cause movement. Fast speed of response was imperative in this operation both for safety and for stability of control. Precision pilots, besides operating with less hysteresis, give this necessary added speed of response. To say this would normally be expected would not be fair to those writing the specifications or those selecting equipment as all facts, especially in specialized jobs of this sort, cannot be transmitted from the engineer writing the specification to the engineer selecting the equipment by means of a simple specification.

The cooperation between the authors, their staff and the control engineer on the job which is obvious from reading the article, is certainly commendable. If new instruments are to be developed for these specialized fields, it is certainly this type of cooperative control application research which will bring it about.

N. J. JANISSE
Manager of Field Engineering
Johnson Service Co.

Prefers On-The-Job Training For Hospital Engineers

I HAVE READ the article, *How to Start a Maintenance School,* by Richard T. Danks, in the August issue, and I must say that Mr. Danks' remarks are very good and true. It does my heart good to see someone take the initiative to start a hospital maintenance school.

The need is greater than that indicated by Mr. Danks. There are too many hospital engineers who are killing themselves by long and excessive hours of hard work. The demand upon hospital engineers is greater than that on the medical profession. He is on call 24 hrs a day and lives a tougher life than medical interns. If a doctor fails to do his job, it may only affect one patient. However, if the hospital en-

Continued on page 102

"Open for Discussion"

Continued

gineer fails to do his duties, the whole hospital may be in serious trouble, affecting all patients and hospital personnel.

Mr. Danks is indeed fortunate that he represents a group of hospitals where such a program can be undertaken. He is also fortunate if he has maintenance men who can and will respond to correspondence courses. I have found it very hard to get maintenance men to read and comply with simple operating and maintenance instructions. I am a firm believer in on-the-job training where details of the work can be shown and explained. The average maintenance man learns by performing the work.

Is Good Training Possible?

The greatest weakness in our education system today is developing readers who understand what they read. If a man has the ability to spell, read, write, and talk he can apply himself to any correspondence course. I wonder how many hospitals have this type of men on their plant and maintenance staffs.

The best program that I have studied for hospital maintenance men was established by Daniel M. Roop, (hospital consulting engineer) when administrative engineer for the Baptist Memorial Hospital, Memphis, Tenn. It was called "Engineering Resident Training Program," consisting of approximately one yr of on-the-job training, (see article in September 1958 HPAC by Mr. Roop also).

Suggests Academic Cooperation

It is the small and independent hospitals who need engineering and maintenance training the most. I believe this can best be accomplished by cooperation of engineering and medical colleges in offering a series of short on-the-job training courses at our large medical centers. It is done for other types of engineering, why not for hospital engineering and maintenance?

J. A. Millard, P.E.
Hospital Consulting Engineer

The Author's Reply — We agree with Mr. Millard as he expressed himself regarding my article *How to Start a Maintenance School* in the August issue, that "on the job training" is the best.

This is why each chief engineer must spend several months at St. John's Hospital here in Springfield. A major portion of the program, however, is the "skill improvement phase". This is to assist any maintenance man or chief to acquire greater knowledge in a specific field. Geography, time, money, and other obvious limiting factors prevent the training of each and every craftsman at a central location.

In 1957, we visited with Dan Roop at Baptist Memorial Hospital, in Memphis. At that time Mr. Roop's program was for graduate and undergraduate engineers. We, as do most small hospitals, have few graduate engineers; therefore, our need is somewhat different than Mr. Roop's. We have also visited Joe Regan at St. Francis Hospital in Peoria. We visited industry as well as other training facilities. From all of these various endeavors was chosen what we thought best for our needs. There is probably no single concept which is new or unique in this training program. It is expected that improvements and refinements will be made to this meager effort of ours. To have the program set up so that college credit could be obtained would be a significant improvement.

Richard T. Danks, P. E.
Supervising Engineer
Hospital Sisters of the Third Order
of St. Francis
Springfield, Illinois

Eliminate Freeze-Up By Using A Single Heating-Cooling Coil

I would like to take this opportunity to comment on the article, *More on How to Provide Freeze-up Protection for Heating and Cooling Coils* which was published in the September issue.

So much has been said that comments on the comments seem almost superfluous. There is one item, however, that seems of sufficient importance to warrant further consideration.

If we are realistic, we have to recognize that in many large installations, draining of the cooling coils before freezing weather is impossible. Many days require cooling after freezing sets in.

Mr. Rottmayer rightfully points out that a much better solution is to pass hot water through the coil to avoid freeze-ups. Mr. Alyea apparently would settle for water flowing through the coils, even if the water were not heated.

Most certainly, the hot water is a more positive solution, but in either case, the fact seems to be overlooked that in most installations the cooling coil is used for cooling alone, and does not have provision for circulation of water whether or not a small or large quantity of either hot or cold water circulation is required.

Where separate cooling and heating coils are used, the automatic controls usually bypass all or part of the circulating water whenever the cooling thermostat is satisfied, as is the case in cold weather when the coils freeze. Therefore, whether or not a reduced

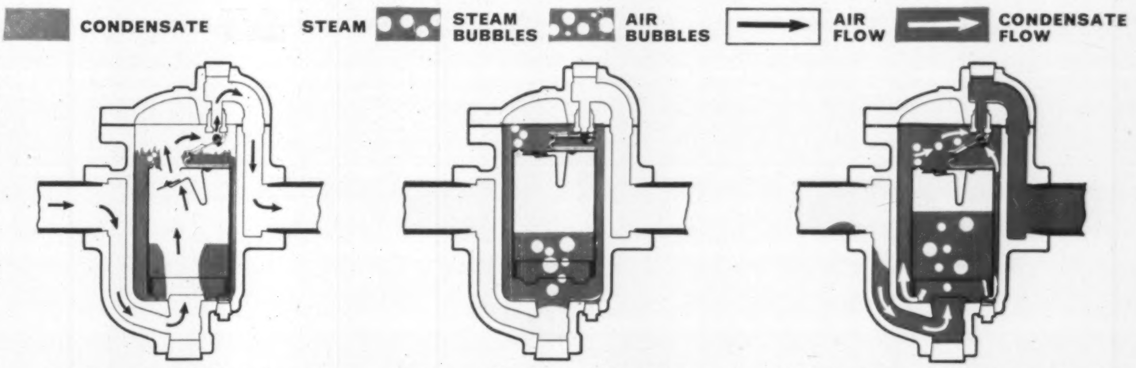
Continued on page 105

Just How Does an OF&T* Trap Differ from an Inverted Bucket Trap?

*Open Float and Thermostatic

A frank statement about the design and purpose of a trap with a confusing name

First, let's take a look at the way an OF&T trap works—



1. Steam pressure pushes air through large thermostatic vent and out through the trap discharge valve at full differential pressure between the supply and return line. Condensate formed by incoming steam also goes right through trap.

2. Steam reaches trap. Thermostatic vent closes. When ⅔rds full of steam bucket rises to close trap valve. Residual air and CO_2 now escape through standard vent **at steam temperature.**

3. Condensate arrives displacing steam causing bucket to lose buoyancy and pull on valve lever. Weight of bucket, multiplied by the leverage, opens the valve against steam pressure. Condensate is discharged until steam restores bucket buoyancy.

An Armstrong OF&T trap *is* an inverted bucket trap, but is does have some important differences:

1. An OF&T trap is equipped with a thermostatic vent for removal of large volumes of air encountered on start up.
2. Discharge orifices are sized to remove large volumes of condensate at low pressures (0-15 or 0-30 psi).
3. Pipe connections are oversized to meet piping requirements of low pressure intermittent service.

We felt these differences were sufficient to justify a new name—if only to simplify discussion, specifying and ordering. However, some of our friends and competitors have said that the OF&T trap was only an inverted bucket trap with a thermostatic vent. We take this as a compliment because our whole idea was to make the many proven advantages of Armstrong Inverted Bucket Traps conveniently available for low pressure service where large amounts of air are encountered on start-up. (We also figured we could sell more traps this way which we have.)

Inverted Bucket Advantages

CONTINUOUS VENTING— In addition to the big air venting capacity on start-up provided by the OF&T design, the basic inverted bucket principle provides continuous air venting after the trap is hot. Air and carbon dioxide escape through the fixed vent in the bucket and are discharged when the trap valve opens. This continuous venting of air and CO_2 is accomplished simply by the difference between the density of the steam-air-CO_2 mixture in the bucket and the density of the condensate surrounding the bucket. No cooling lag is required that would permit CO_2 to go into solution to form corrosive carbonic acid.

DIRT HANDLING — The turbulent flow of condensate under the edge of the inverted bucket and the fast sinking—fast floating action of the bucket keep dirt in suspension so that it is discharged along with the liquid. There is no likelihood of dirt lodging in the valve seat and no possibility of sludge accumulation on a bellows.

CORROSION RESISTANCE — The entire mechanism of Armstrong OF&T traps is economically fabricated from stainless steel—more corrosion resistant than parts usually used in other types of traps for low pressure intermittent service.

DEPENDABILITY — The ability of the OF&T trap to keep itself clean and the use of stainless steel parts contribute to dependability and long life. Unlike some other types of traps for this kind of service, OF&T traps "fail open"—a remote possibility but an important safety feature.

What Should You Do About It?

From our admittedly biased viewpoint we think that Armstrong OF&T traps should be used exclusively on low pressure intermittent service. This may not be so obvious from your viewpoint.

Nevertheless, we think it will be well worth your while to investigate OF&T traps for trapping requirements on low pressure unit heaters, preheat and reheat coils, converters, hot water generators, etc. The following printed material available on request will help you:

Catalog K — The inverted bucket story in detail.

Bulletin 252—Trapping Unit Heaters (including recommendations by make and model).

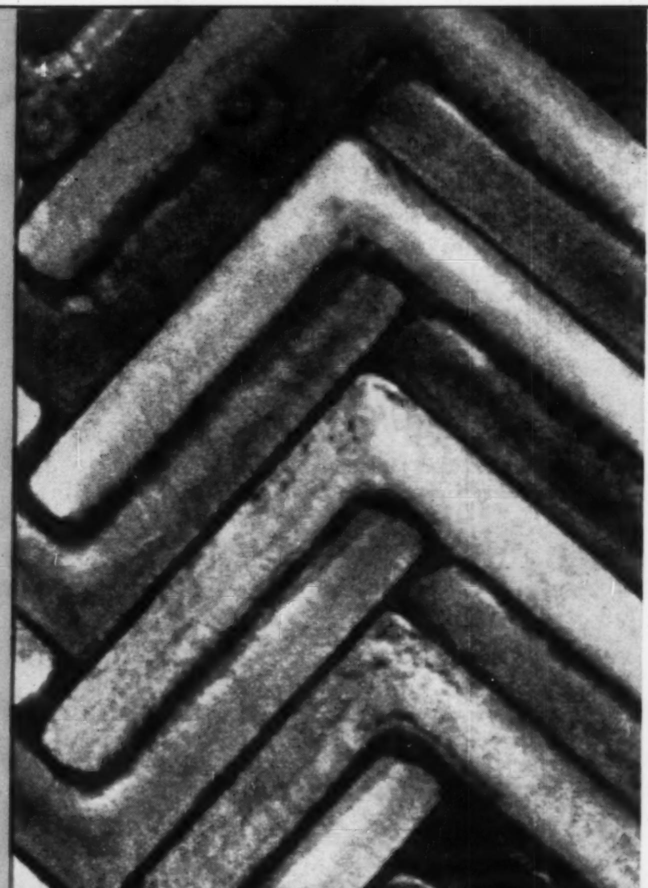
Bulletin 254—Draining and venting preheat and reheat coils.

Ask your Armstrong Representative or write: **Armstrong Machine Works, [illegible]44 Maple Street, Three Rivers, Michigan.**

P.S. Just to humor us and for safer communication, we would appreciate it if you would refer to our inverted bucket traps with thermic vents and big pipe connections as Open Float and Thermostatic Traps.

**ARMSTRONG
STEAM TRAPS**

112-ST



tufkote

Call your Steel Service Center for fast delivery of Youngstown tufkote and quality bar size angles

Corrugate a building panel. Lock-seam the ends so they connect to finish a side. Deep draw a feeding trough. Crimp, stamp, bend, form. Make ductwork. You'll never flake or peel the tightly bonded zinc coating of new Youngstown **tufkote.** Its finish is better. It's Youngstown steel. It's the finest galvanized sheet you can buy—rolled and coated by the steel industry's newest mill facility.

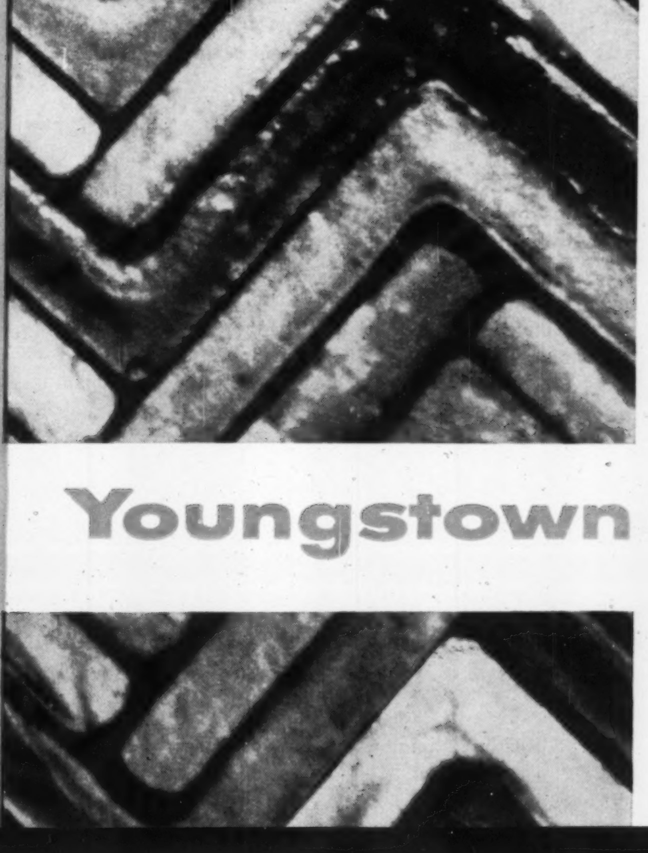
Get fast, dependable delivery of Youngstown **tufkote** from your nearby Steel Service Center. Choose cut lengths and coils. Get the exact coating thickness, finish and adherence to meet your specs. To complete your construction "package", order hot rolled angles and bars in all standard sizes from stock, ready now for immediate delivery.

Get **tufkote** galvanized steel from Youngstown. Fast availability from your Steel Service Center. You can depend on both to reduce manufacturing costs, improve product and increase your profits.

Youngstown – growing force in steel

For **tufkote** data: coils, cut lengths, flat, corrugated, write: Dept. 10A.
The Youngstown Sheet and Tube Company, Youngstown, Ohio

STEEL SERVICE CENTER INSTITUTE



"Open for Discussion"

Continued

amount of circulation through the coil would prevent freezing, the automatic controls are such to prevent circulation through the coil and the stagnant water defies the basic principle of requiring circulation regardless of quantity and temperature.

The irony of this situation is that if a single coil is provided for heating and cooling, and hot water and cold water are constantly available under thermostatic control to this coil, we not only solve a problem, but reduce first cost. It seems hard to reconcile avoidance of this solution.

When the remaining benefits are examined, using a hot and cold water source to the coil with a common return, there are many dividends. For instance, the cooling surface is always greater than provided for normal hot water temperatures, generally above 150 F. Therefore, if we take advantage of this greater cooling surface in our heating coil, lower water temperatures can be used for heating in the winter. If we control the cooling water temperature to a maximum, and the heating water to a minimum in between seasons, the hot water and cold water will leave the coil substantially at the same temperature, which greatly improves the efficiency of a three pipe system.

Plan Also Allows Single Pump

Also under these conditions, a single pump can be used for hot water and cold water, passing the water to be heated through a double condenser, and then through a converter to act as a booster in cold weather when more heat is required than available from the condenser. This results in further savings in first cost to produce more economical operation, and goes far to solve the freeze-up problem.

We have to go farther than expressing a basic truth such as the requirement of flow through the coil during freezing weather. We have to work out how this is possible, especially with separate heating and cooling coils, and make provision for use of the cooling coil on warm days before and after subfreezing outside temperatures are prevalent.

A. I. McFarlan
President
A. I. McFarlan Co. Inc.
Mechanical Contractors

HTHW "Design Rules" Make Sense, But Must Be Interpreted Correctly

The author's conclusions in the article, *HTHW System's Operating Problems Uncover Valuable Design Rules* (August 1960) appear to follow quite logically from the problems encountered. With respect to those conclusions —

His first sentence under conclusion No. 1 is as follows: "The temperature drop along supply mains under minimum load conditions should always be carefully evaluated, and an automatic by-pass (either pressure or temperature controlled) should be installed at, or close to, the end of each main." The statement tends to give the impression that the author is suggesting that the automatic bypass valve always be installed. Actually, under conclusion No. 4 he appears to recognize that they are not always needed in the statement "plus the effect of the bypass (if any) at the end of the supply main."

Supports Need for Analysis

Under conclusion No. 4 the author points out that the expansion tank cannot be sized on a basis of assuming a range of temperature variations for the supply and return line and indicates the reasons for an analysis of temperature variation in the return line. There is at least one other reason for making this analysis suggested by the author which may be even more important than the problems encountered in expansion tank sizing.

Temperature Drop May Be "Wrong"

Failure to properly analyze the return temperatures may lead to an erroneous selection of temperature drop across the boiler, thus leading to failure to properly calculate the flows to the boiler and development of a system which cannot actually produce the design capacity of the high temperature water generators installed.

B. L. Sturdevant
Stanley Engineering Co.

The Author's Reply — Mr. Sturdevant is quite justified in pointing out the discrepancy between two of my statements regarding automatic by-pass valves. I can only say that while I, personally, recommend the installation of such valves in all cases, some engineers do not feel that they are always justified, while others seek to obtain the same result by other means, *e.g.* by the installation of small manual by-passes at each heat exchanger.

Agrees Return Temperature Is Vital

Mr. Studevant's second point is also well taken. The selection of the boilers is normally based on the "design load" and, for the same total load and supply temperature, the return temperature can vary widely with the type of load supplied. Thus, a sys-

Continued on page 108

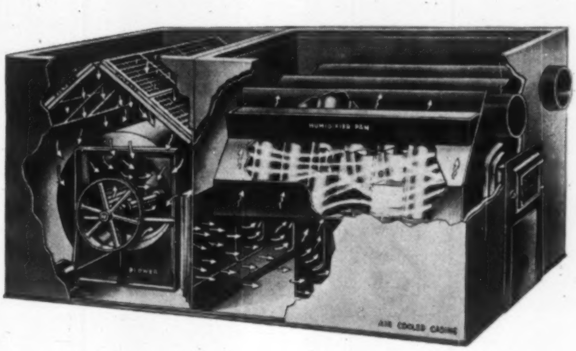
Campbell

WARM AIR HEATERS
FOR LARGE BUILDINGS

Community School, Ocheyedan, Iowa, heated with an oil-fired Campbell 8000 Series Heater. Architect, the Griffith Co., Ft. Dodge, Iowa; Engineer, LaBelle Engineering Co., Sioux City, Iowa; Heating Contractor, Christians Sheet Metal Co., Spencer, Iowa.

REAL HEATING ECONOMY

The proven economy of Campbell Warm Air Heaters gives you added assurance of customer satisfaction. Moderately priced, easy to install; they deliver quick abundant heat with exceptional fuel economy; and give long dependable service. Campbell Heaters provide positive control of temperature, humidity and ventilation. They are extremely quiet; a very important factor in schools and churches. For efficient, economical warm air heating, let Campbell's bid on your next job.



MANUFACTURERS' AGENTS

We have some attractive openings for men calling on heating engineers, architects and contractors.

CAMPBELL
HEATING COMPANY

Des Moines 17, Iowa

"Open for Discussion"

Continued

tem which contains a high proportion of steam generators will obviously have a much higher return temperature (and a correspondingly higher pump capacity) than a system of equal total load composed principally of air heating coils and water heaters.

Mr. Sturdevant's comments indicate, I believe, that he and I agree completely that a competent choice of the major components of a HTHW system such as boilers, expansion tanks, system pumps, etc., can only be made on the basis of a rational analysis and evaluation of the system as a whole with its various components, and that to rely on the general rules so often advocated can sometimes result in costly errors.

J. P. O'F. Lynam
Consulting Engineer

Cites Factors to Explain Moisture Migration Variations

THE TESTS reported by Mr. Zablodil in the article *Tests Reveal Moisture Migration Rates Through Variously-Constructed Walls* (September) represent an interesting extension of the basic technique used at Pennsylvania State University to study full-scale composite wall sections. The results presented form a useful contribution to the limited published information on the properties of exterior walls of buildings, but do contain some discrepancies which might be questioned on an analytical basis. Their direct application to design, without regard to other factors involved, might also be open to some argument.

Consider Unit Pressure Difference

The discrepancies in the test results become apparent when the moisture rates listed are expressed in terms of unit vapor pressure difference. On this basis, the test results for walls Nos. 1, 2, 6, and 8 indicate an increasing permeance with decreasing mean relative humidity and increasing temperature. The values for walls 4, 5, 7, and 9, however, show a maximum permeance value for the intermediate test condition while for wall No. 3 this value is a minimum. These variations cannot easily be reconciled with the changes in test conditions, and it would appear that some other variable influence is involved.

Experience at this laboratory in connection with heat and moisture studies on masonry walls has indicated that a considerable length of time is required to reach moisture equilibrium, several months in some instances. During this period, the rate of moisture transfer appears to change progressively until an equilibrium moisture gradient is established through the test section. If the "soaking" period referred to in the paper only involved storage of the specimen at some mean humidity, rather than under the test conditions, it could be that the moisture distribution within the panel did not reach a final equilibrium condition during test. The test procedure as described involved only an initial and final determination of desiccant weight gain for the test period, and it would be difficult to establish whether a constant rate of vapor transfer, and hence an equilibrium moisture gradient, had in fact been established.

Air Pressure Also a Factor

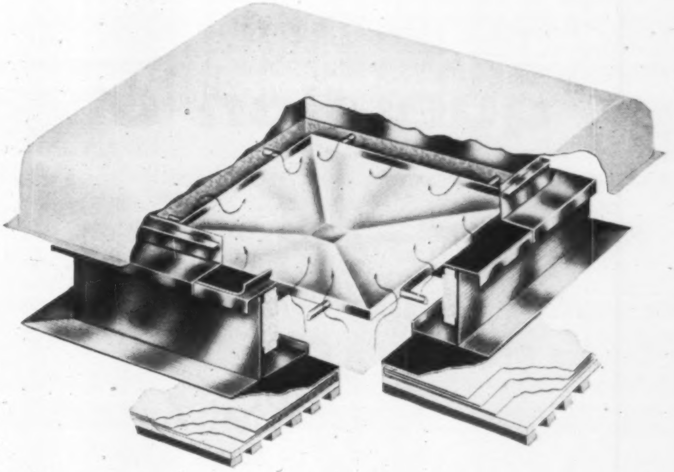
Another more significant influence which could possibly affect test results is the mass flow of air through the test specimen under a total pressure difference. Unless special provisions for balancing pressures across the test panel were provided, pressure differences created by forced air circulation or by the normal fluctuations in barometric pressure could be experienced. Barometric pressure fluctuations with only one of the test chambers vented, for example, could result in a variation of vapor transfer rate with time and might serve to explain the discrepancies previously noted.

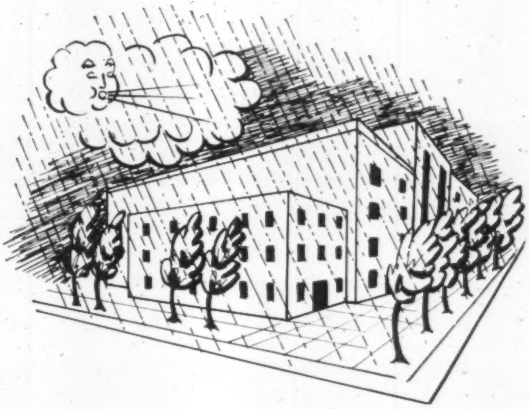
Suggests Practical Qualification

The effect of total pressure differences on water vapor transfer through walls must also be recognized in the application of laboratory results to design and to the investigation of field problems. Such differences are unavoidable in practice, resulting as they do from wind, chimney action within the building, and from mechanical air circulation. The mass flow of air through exterior walls caused by these forces may, under some conditions, easily involve rates of vapor transfer many times those that can be accounted for by vapor diffusion alone. Cracks and openings which may occur in the various wall materials can afford the most extreme departure from predicted performance, but air movement through the materials themselves may also be significant. For this reason, the values given in the paper may have limited application without some knowledge as to the air leakage characteristic of the wall sections.

G. O. Handegord
Officer-in-Charge
Prairie Regional Station
Division of Building Research
National Research Council
Saskatoon, Saskatchewan

FORGET WATER DAMAGE FOREVER





The ULTRA SONOTROL CURB*

Now, there is no need to compromise the many advantages of exhausting or supplying air through roof mounted, powered and/or gravity ventilators because of possible leaks. Before the development of the ULTRA SONOTROL Roof Curb every hole provided for a ventilator opening was a potential trouble spot.

If you want to get air in or out an opening is required. Our nearly 35 years in designing, manufacturing and marketing roof ventilators has taught us no matter how protected that opening may be, it cannot be 100% watertight under every conceivable condition of wind, storm and weather.

The ULTRA SONOTROL fills the breach. Its exclusive Storm Shield serves as a built in drip-pan. Hurricane gales cannot drive moisture in to water stain ceilings and to buckle or warp wooden floors and joists. The Ultra Sonotrol effectively attenuates sound and with a minimal pressure loss. It also has all the advantages a factory fabricated roof curb has over the uncertainness and expense of field construction.

The curb and ingenious Storm Shield make the best uses of corrosion free fiberglass and aluminum. All water particles that may enter gravity or powered ventilators or fresh air intakes are trapped by the Storm Shield. Water is held until evaporated or passed to the roof through an optional drain tube. No part of the assembly projects below the roof deck to interfere with structural supports.

Read more about this latest Penn Ventilator engineering achievement and how you can eliminate the risk of water damage during severe and extreme weather periods. Send for your copy of Bulletin SC-90 today.

**Fully Protected By Patents Pending*

PENN VENTILATOR CO., Inc.
PHILADELPHIA 40, PENNA.

A leading manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 30 years.

Member of AMCA

Penn Ventilator products are available throughout the Free World.
One of many direct factory representatives at your service:
J. R. DOWDELL & COMPANY, THROUGHOUT TEXAS

question of the month

"What Are the Use Limits On a One-Fan Supply/Exhaust System?"

This question was asked previously in Heating, Piping & Air Conditioning, and is repeated here, along with two answers that have been received. Your comments for publication are invited.

"Will a single fan system with variable outdoor air supply operate satisfactorily in a small commercial building? The diagram below is an example of such a system.

"I really would like general answers to this question since such systems may be applied on various types of buildings.

"I have recently designed such a system for a 25 unit suburban office building requiring 14 tons of air conditioning capacity and an air flow rate of 6000 cfm. An underfloor supply system was used and air returned through 25 return air intakes to a ceiling plenum. There were interior rooms (with skylights) which required heating in winter but cooling at noon. A variable outdoor air system was required to obtain an air temperature of 60 F when the cooling tower and compressor were shut down. There was neither space nor money for a return/exhaust air fan.

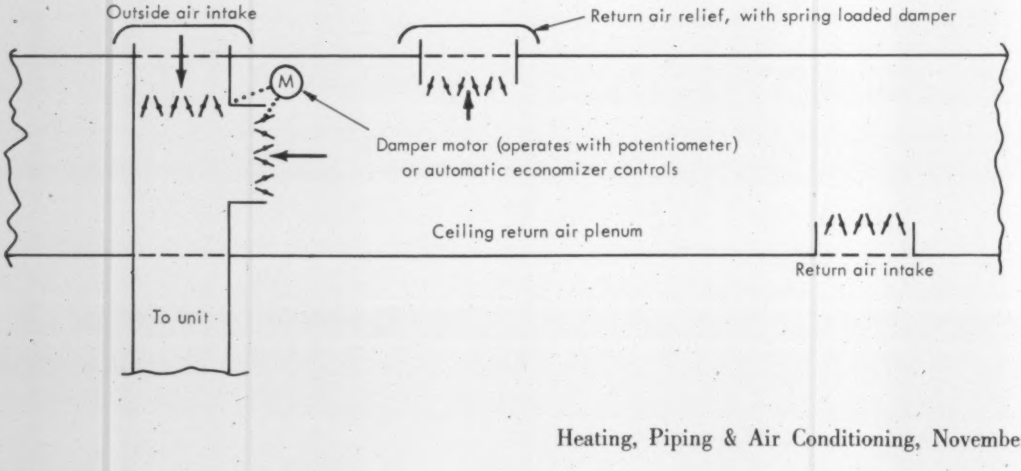
"I know that this system will work. The real question is just where can such a system be used and how large can it be.

"This system, operating at 0.80 in. S.P. normal, will have its air quantity reduced 6 percent when operating at 0.90 in. to pressurize the rooms. On a system operating at 2 in. S.P. total volume will be decreased further to accommodate the increased outdoor air being admitted."—P.J.B.

One Restriction Can Be Actual Security of Building

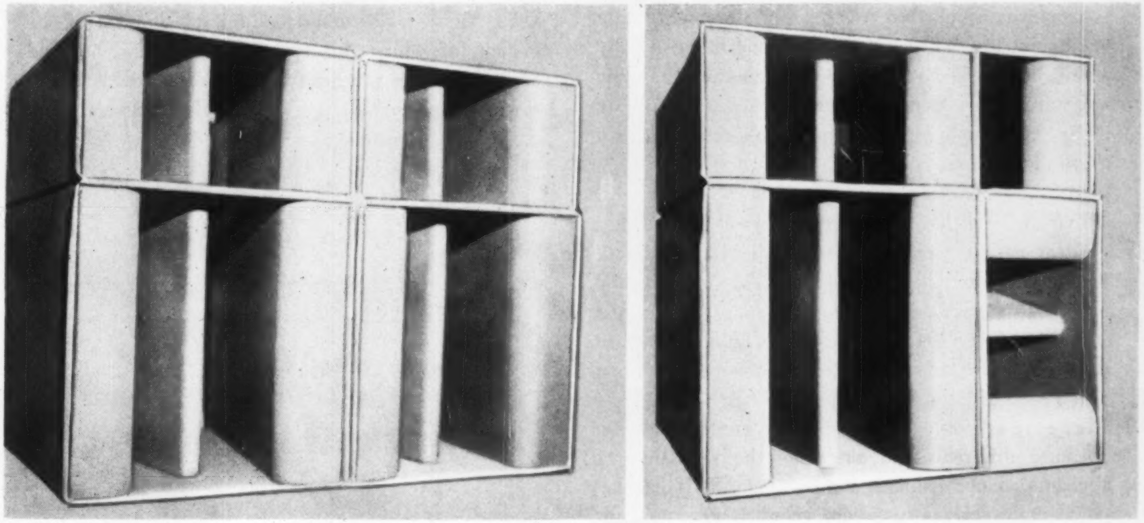
THE ARRANGEMENT for variable outdoor air supply up to 100 percent for air conditioning that P.J.B. proposes can be used generally, and I see only one reason to place any restriction on its use.

Continued on page 112


Outside air intake
Return air relief, with spring loaded damper
M
Damper motor (operates with potentiometer) or automatic economizer controls
Ceiling return air plenum
Return air intake
To unit

This is UNI-SILENCER*

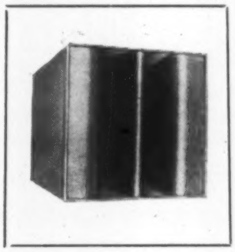
*Reg. U. S. Pat. Off.



Uni-Silencers in parallel — (*At left*) Two full units and two half units slip-jointed together to form a combination 36 inches by 48 inches. (*At right*) One full, two half, and one quarter-size units slip-jointed together to form a combination 36 inches by 36 inches.

Modular System Effects Important Savings

Uni-Silencers are made in sensible, small, manageable units, and slip-joined like children's building blocks. This eliminates the need for cranes, hoists or other rigging. No matter how large the system required, it can be composed of these standard, modular units, each of which can easily be carried by one man. This advanced precision method permits installation at a cost comparable to conventional duct lining — in some cases, at less cost. Developed by the Elof Hansson research laboratories, Uni-Silencers are proving superior, on the job, in the most modern structures from coast to coast.



A complete line for every purpose — There is a range of 7 models to reduce effectively the airborne noise generated by fans in air conditioning and ventilating systems and by power roof ventilators. Special units are engineered for unusual job conditions.

Send for free, informative engineering tools — *Uni-Silencer Selection Chart* eliminates guesswork in selecting the right type of silencer for **your** particular problem of noise control. Gives accurate directions with examples of efficiencies, explanatory graphs, and Noise Criteria for Rooms, with recommended NC curves. *Uni-Silencer Catalog* #160 includes complete data on each of the 7 different models in the line.

There is a Franchised Representative
in every major city in the U.S. and Canada.
Write for name of nearest representative.

ELOF HANSSON, INC.
ACOUSTICAL DIVISION
711 Third Avenue, New York 17, N.Y.

question of the month

Continued

The comment I have to make proceeds from the statement "there was neither space nor money for a return/exhaust air fan." From an air conditioning standpoint this fan is not a must, but from a security standpoint it is. By security I mean the automatic closing of doors as people enter or leave the building during off hours. The buildup of air pressure within the building does not have to exceed 0.01 in. WG to hold a rather large door open against the door closer.

One incident like the above may make the owner and the engineer realize that space and money *must* be found for a return/exhaust fan. The incident may occur when a late working occupant leaves the building when the fan is bringing in sufficient air to create enough pressure to hold the outside door open and invite unauthorized people to enter.

The return and/or exhaust of air depends on pressure differences to overcome the resistance of registers, ducts, exhaust dampers, etc. This has become more serious in recent years as new methods of manufacturing windows and doors make them increasingly air tight. Old construction is not as bad.

James Marshall
Consulting Engineer

Sees No Size Restrictions If Some Precautions Are Taken

It is our opinion that it is highly desirable wherever possible to design the system so that the outside air quantity may be varied from a minimum quantity up to 100 percent. In most localities there are many days in which the outdoor temperature and humidity are such that reasonably good conditions may be obtained within the conditioned area using only outside air as a cooling source.

We do feel that the use of a return/exhaust air fan offers the best solution for maintaining a proper balance between air intake and air exhaust. However, as P.J.B. points out, it is not always physically or economically possible to provide the return/exhaust air fan system. A spring loaded relief damper (or dampers), properly located, probably offers the next best method of exhausting the excess air. We have tried using motor operated exhaust dampers, but have had considerable difficulty in sensing pressures (or pressure differentials) so that the exhaust damper motor could be satisfactorily controlled.

The following considerations should be given to the locations of relief openings:

1) Locate the relief as close as possible to the conditioned area since any pressure drop between the conditioned area and the relief opening would manifest itself by requiring a greater space static pressure.

2) The relief opening should be located and designed in such a way as to avoid back drafts due to wind forces. It would be desirable to locate both intake and relief openings so that they would be subjected to identical wind forces.

3) There is virtually no limit to the size of the system for which this type of relief could be used as long as it is physically possible to provide a sufficient relief area. It would certainly be desirable on large systems to have a number of relief openings located so there would be no objectionable drafts.

Hollis U. Bible
Consulting Engineer

READER ASKS —

"What Are Reasonable Amortization Periods For HPAC Equipment?"

"We are in need of knowing where up-to-date information can be obtained on the expected life of heating, piping, and air conditioning equipment for large building installations.

"We have recommended a composite life of 15 years for a large air conditioning system in one office building, and the manufacturer has recommended that about $60,000 of the cost should be depreciated over a 10 year period and the remainder (such as ducts, etc.) should be depreciated over a 15 year period.

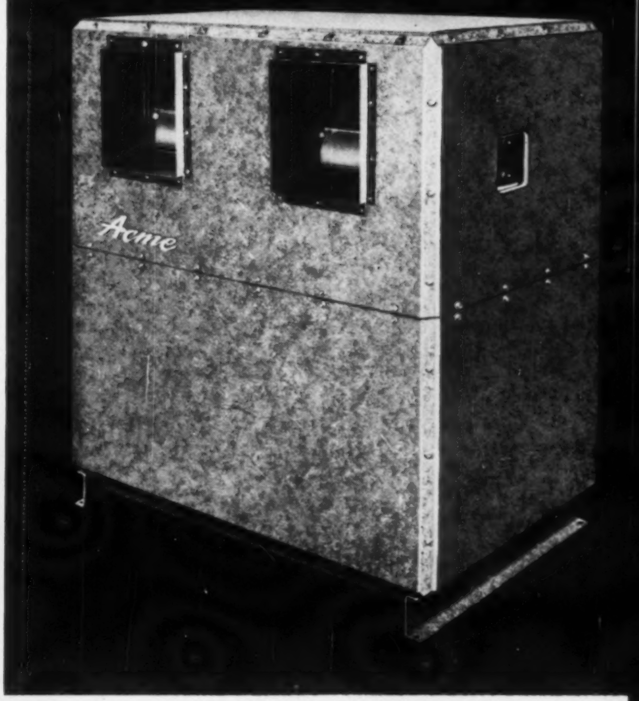
"When the Internal Revenue agents examined our return, a 20 year life was substituted and we did not question or protest the change.

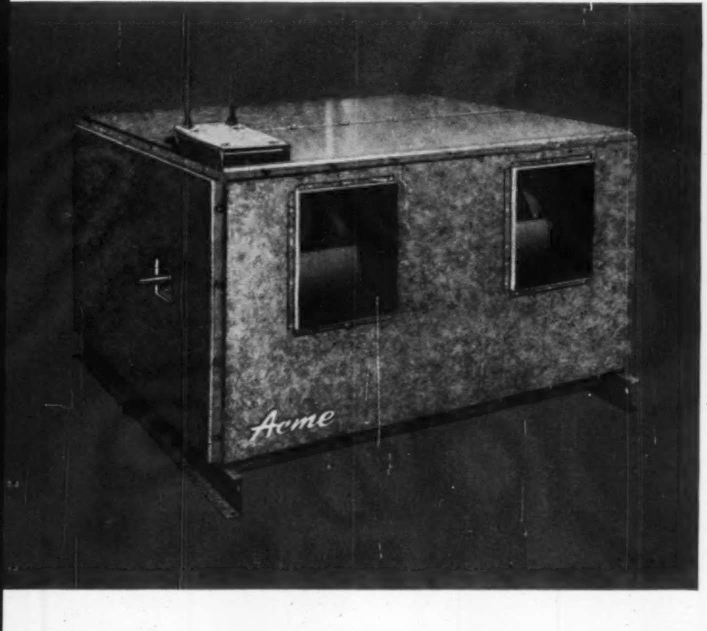
"In view of these different recommendations, we would like to see some reliable and up-to-date information on this subject." — **G.C.C.**

YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Acme Announces

A NEW AIR HANDLER LINE



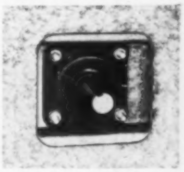


engineered to your specifications

After years of intensive laboratory and field research and development work, Acme is proud to announce *a new advanced-design line of air handlers* for heating, ventilating and cooling applications . . . a line that features a host of engineering and construction refinements most wanted by architects, consulting engineers, contractors and building owners nationwide.

Installation flexibility, for example . . . to meet virtually any requirement you may have . . . is provided in several ways. From two to four coil sizes, in either right or left-hand combinations, are available in each casing size . . . six motor positions and four fan positions are offered . . . and on multi-zone units, mixing and filter boxes may be arranged vertically or horizontally.

All sections are made from rolled sheet steel, angle irons are eliminated, corner post construction offers greater strength and rigidity. Panels, built on specific centers, are securely fastened with self-tapping, hexagon head screws to prevent air leakage, facilitate panel removal when necessary.



Only external, sealed self-aligning "Sealtite" ball bearings with "Alemite" fittings are used to simplify service and maintenance. Fan mount shafts are hollow, designed and sized to minimize shaft deflection, increase bearing life.

There's more, much more . . . including the fact that the line includes 37 different horizontal, vertical and multi-zone type units, 14 sizes, capacities to 44,000 cfm. An Acme Air Handler for every application. For complete details, fill out coupon below and mail it today.

Acme INDUSTRIES, INC.

JACKSON, MICHIGAN • GREENVILLE, ALABAMA

MANUFACTURERS OF QUALITY AIR CONDITIONING AND REFRIGERATION EQUIPMENT SINCE 1919

ACME INDUSTRIES, INC.
JACKSON, MICHIGAN

GENTLEMEN: Please send, immediately, literature on your new Air Handler line.

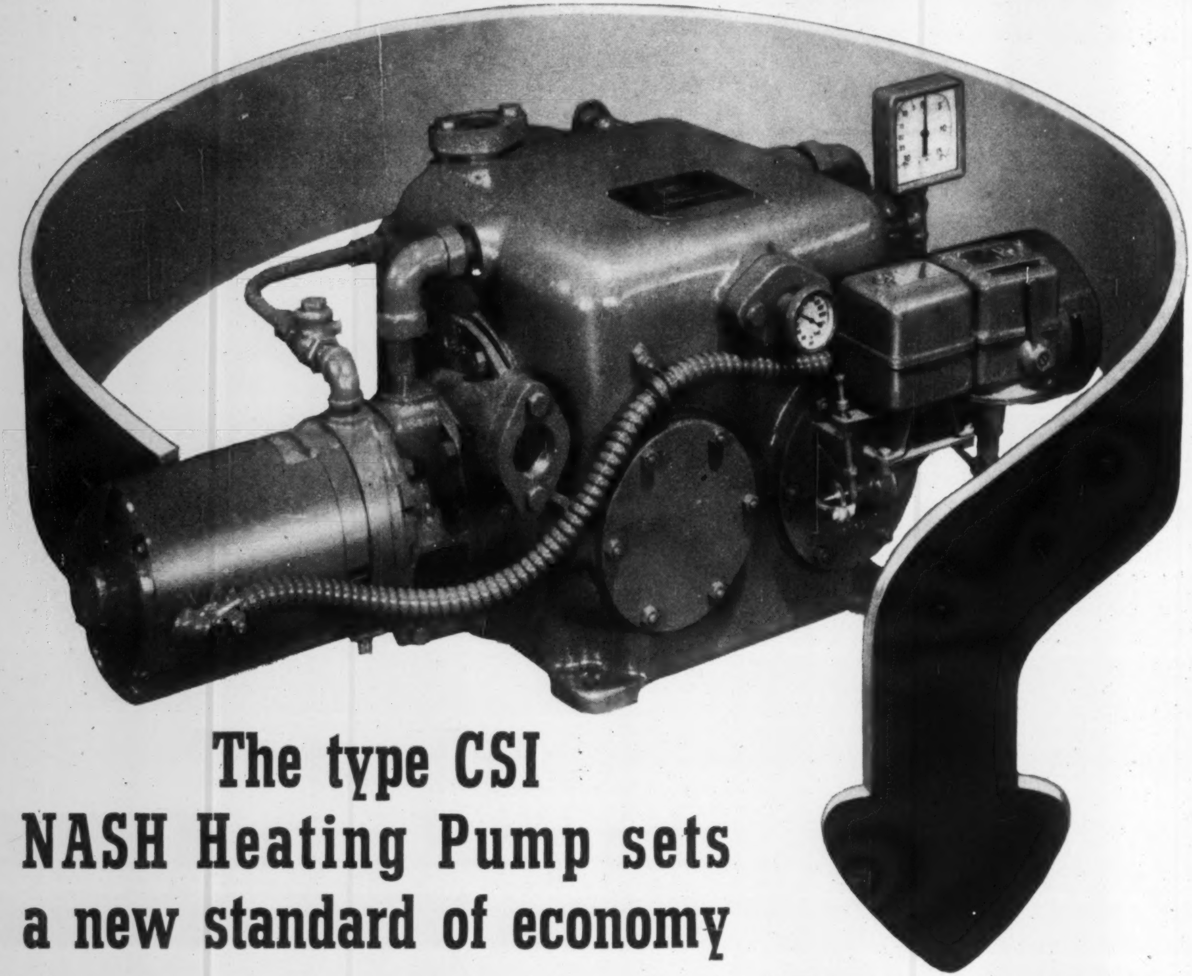
NAME______________________________

COMPANY______________________________

ADDRESS______________________________

CITY______________ ZONE______ STATE________

It's a NASH Heating Pump, PLUS!



The type CSI NASH Heating Pump sets a new standard of economy

Now a Nash quality Vacuum Heating Pump can be economically installed and operated on any steam heating job. Engineered for high performance and low installed first cost, this new pump still makes use of time tested Nash principles of operation.

The Nash CSI has generous air capacity and features a wide choice of water capacities and discharge pressures. The right combination of capacities is at hand to match the requirements of the job. It is no longer necessary to pay extra for a pump with excessive water capacity, excessive discharge pressure, or in an attempt to get adequate air capacity.

With this advanced design, Architects, Engineers and Contractors will find answers to many heating system problems. Send for bulletin now.

1 **ECONOMY IN FIRST COST**

2 **ECONOMY OF INSTALLATION**

3 **ECONOMY OF OPERATION**

4 **ECONOMY OF MAINTENANCE**

NASH ENGINEERING COMPANY
449 WILSON, SO. NORWALK, CONN.

An ingenious well water heat pump system using natural gas-driven compressors, supplementary air handling units and individual store air conditioners has been operating in the Southdale shopping center, Minneapolis, for about five years.

How has it worked? What changes have been made? Has it proved economical? Given another chance, would engineers choose the same kind of system again? These and other questions are answered in the accompanying article, which includes some interesting operating data for summer and winter peak load periods.

"World's Largest" Heat Pump Revisited

SOME FIVE YEARS AGO the world's largest water well heat pump system was installed in the then world's largest shopping center under one roof — Southdale in Minneapolis. Bigger shopping centers have since been completed, but the heat pump still ranks as the world's biggest.

HPAC reported the unique features of this design in January, 1957[1]. After several years' operating experience, how well satisfied are the engineers connected with the system? Are the tenants happy?

Architectural Features

Essentially, Southdale is a block-square building on three levels, plus a mechanical equipment penthouse. Two full levels are given over to shops and arcades, with the basement divided between shopping areas, shipping and storage facilities, and security spaces. A truck tunnel extends through the basement level also.

In all, the 75-odd stores take up 660,000 sq ft of Southdale's 800,000 sq ft total space, with the balance used for public areas and walkways. Two large stores, Dayton's and Donaldson's, dominate the center. All stores except Donaldson's are air conditioned by the heat pump installation. Donaldson's has a separate conventional air conditioning system.

An interior 3-story garden court serves as a focal point of the center onto which shops on the middle two levels open. The court is connected with parking areas by 10 arcades. By roofing the entire court, architect Victor Gruen provided for 365 Southdale shopping days a year, even in the extremes of hot and cold weather normal to Minneapolis.

This court was conceived as an architectural feature, but design engineer David Berks put it to good use as a giant plenum, 240 ft long, 100 ft wide, and 3 stories high, for the air conditioning system.

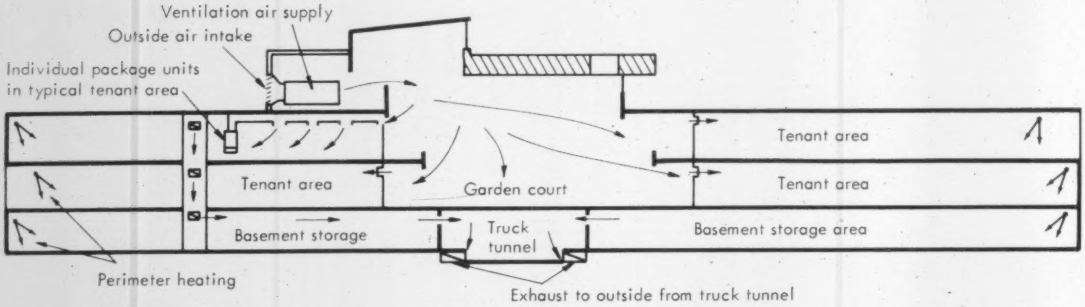
Instead of exhausting air from the shops to the court, the pattern is reversed. Air is taken from outside, conditioned, and supplied at the top of the court, thence to the individual shops through long slots in the stores' "exterior" courtyard walls about 10 ft above the walkways. Air from the shops is exhausted through shafts to the truck tunnel in the basement; then out roof exhausts. The volume of air leaving each store is governed by dampers in the exhaust ducts.

Well Water Cools Court Air

Two intake fans for the court supply from 120,000 cfm maximum to 60,000 cfm when outside temperature is −20 F. In summer, the coils for this air are supplied with 50 F well water; in winter, with return water from a number of 2 to 15 ton packaged air conditioners used to treat air for the individual shops.

---

[1] *600 Ton Heat Pump System Creates "Eternal Spring" in Shopping Center*, Heating, Piping & Air Conditioning, January, 1957



AIR CONDITIONING for tenant areas in Southdale is dual project, using conditioned air from center court plus individual packaged units in each store. Air is exhausted to basement via vertical shafts as shown, thence to truck tunnel running length of basement, and is then released to atmosphere

(Thus are the separate stores in the center air conditioned — with 70 F ventilation air from the court, plus year 'round cooling from individual conditioners.) Maximum supply glycol temperature to the court intake coils is 86 F, returning at 78 F. These temperatures have proved most efficient for operating the packaged units.

Two smaller supply fans (35,000 cfm each) supply cooling and ventilating air to the Dayton store. In that store, chilled water coils are supplied by the heat pump. These coils are mounted above the escalators on each level of the store. Air is supplied to the various areas by ceiling diffusers.

Heat Pump Operation

The unique feature of the Southdale installation is its heat pump, which supplies cooling for the building in summer and in winter extracts people and light heat or, during unoccupied periods latent heat from well water to warm the building. Southdale requires cooling until the outdoor temperature reaches −5 F.

CYCLE
SEQUENCE

DIAL CONTROL arrangement allows equipment to be sequenced for efficiency

Internal Combustion Engine Drive

Five 16 cylinder compressors, each driven by a 12 cylinder natural gas engine are installed in the fourth floor penthouse. During peak natural gas-demand periods, the engines can be switched to propane.

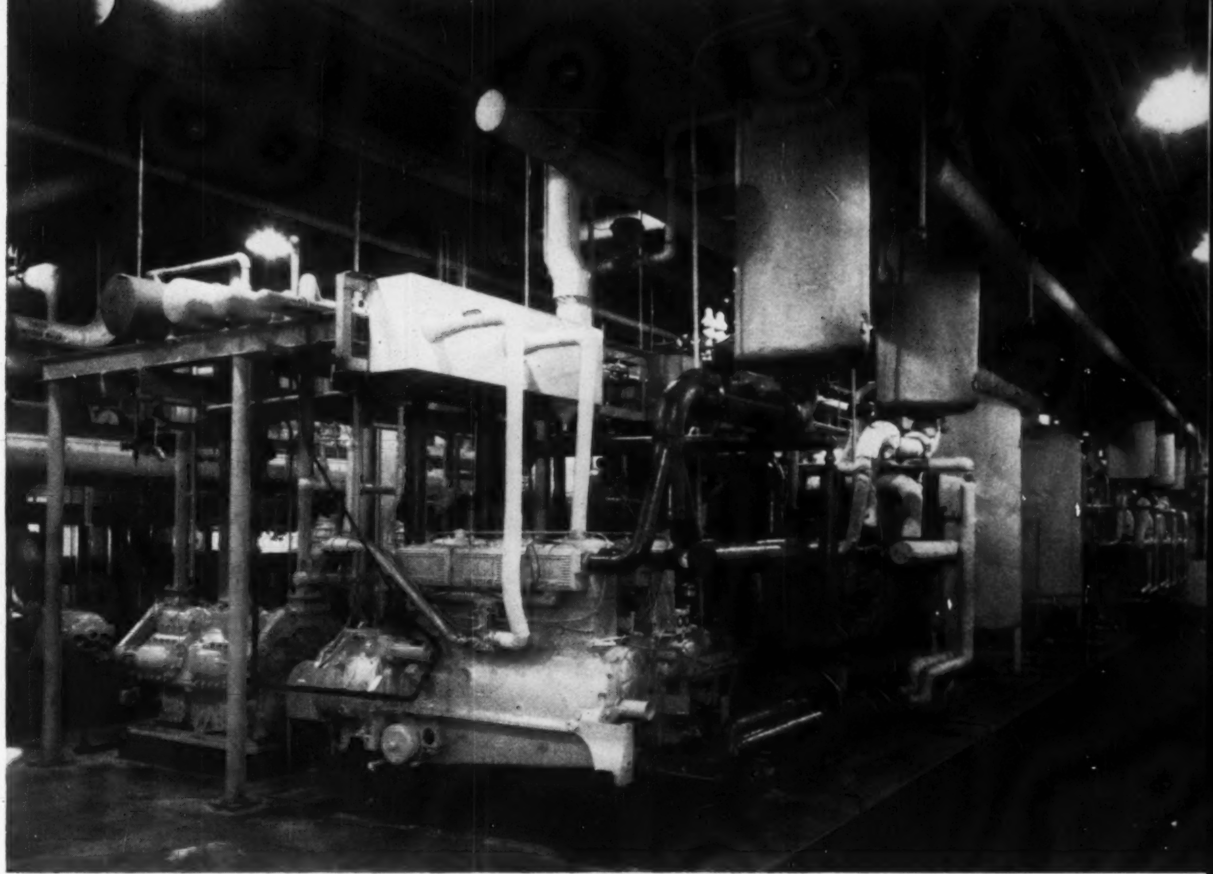
Engine speed and the number of units on the line are controlled automatically by the temperature of the water leaving the chillers. As water temperature rises above 40 F, operating engines are speeded up and/or additional units started until enough compressors are running to hold the water at 40 F. This operation is reversed as chiller water temperature decreases.

Use Variety of Sources

In warm weather, well water is used to pre-cool the ventilating air, as condenser water for the compressors and packaged air conditioning units, and as the cooling water for the gas engines. In winter, heat is extracted from the well water in the heat pump. Heated condenser water is supplied to perimeter fan coil units (see below), and the ventilating units get hot water from the condensers of the individual packaged units.

Heat developed by the natural gas engines is an important addition. Cooling water first passes through an oil cooler in the engine crankcase, then through the block and heads, and finally through a heat exchanger where it picks up heat from the engine exhaust system. This "cooling" water then serves to heat the domestic water supply, glycol snow melting fluid (for the truck ramps) and water for the perimeter heating system.

Of the total heat required, the heat pump supplies



FIVE GAS ENGINES drive heat pump compressors for main air conditioning system. Plans are to add sixth engine-compressor unit when shopping center is enlarged. Cooling water from these engines supplies about one-third of the Southdale winter heating requirement, besides serving to heat snow-melting fluid for the truck ramps to an underground tunnel

approximately two-thirds, and waste heat from the engines the balance.

Perimeter Heating

Engine heat is not always adequate to keep perimeter areas warm in very cold weather. The perimeter system consists of fan and coil units to blanket the outside walls with heated air. When more heat is required, a thermostat in the perimeter system begins the action which replaces the 40 F water leaving the chillers with 50 F well water, putting an artificial load on the system. This increase in temperature is sensed by the engine control thermostat system, and more engines are put on the line to pull the water temperature down, thus providing greater amounts of engine exhaust heat. When the outside temperature reaches −20 F, all engines are running at full capacity.

Water Systems

Three wells supply water for the heat pump. Originally, four were drilled: two deep wells to draw water at 50 F from an underground basin, a third deep well intended to return used warm water to the basin, and a shallow well to serve as an underground heat reservoir. This plan has been modified so that only the two supply wells are carrying out their design functions.

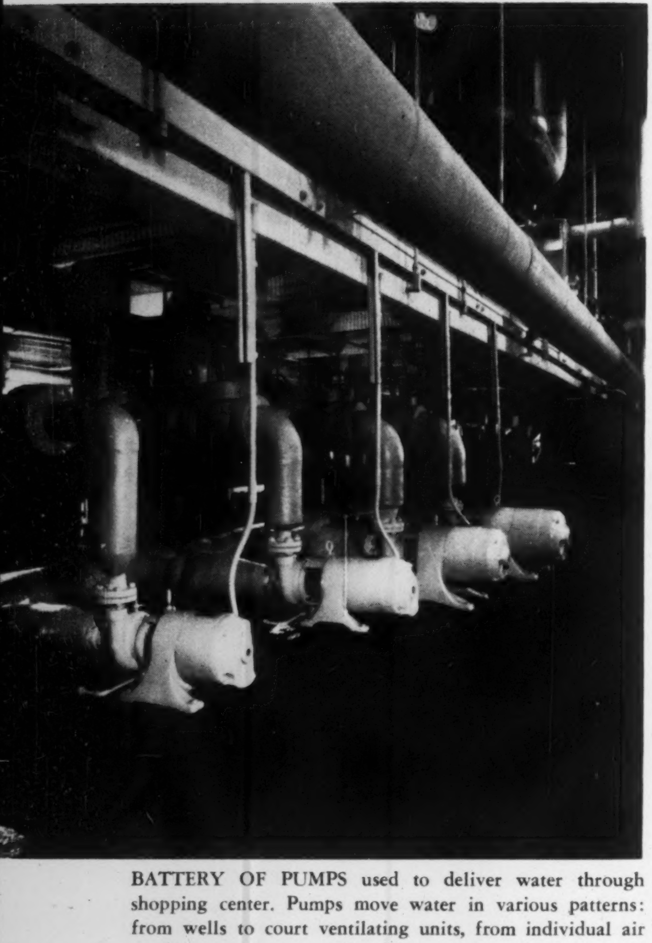
Warm water from the heat pump was to be pumped to the reservoir during the summer and redrawn to help supply heat in the winter. Because of heavy iron precipitates in the water which tend to fill crevices in the underground water basin, however, the shallow well has had only occasional use —returning water from an auditorium and restaurant when they're operating. The well is used as a return only, not as a reservoir; otherwise it is available for standby supply.

Air Conditioning Controls

The whole system is automatically controlled from an electronic control center which operates the equipment on a preplanned sequence — starting and stopping engines, fans, pumps, perimeter heating units and the packaged air conditioners.

A unique telephone-dial unit is used to initiate a specified sequencing operation, thus making sure not only that interior conditions are maintained as desired, but also that all equipment is used in the most efficient order. An automatic data recording system connected with the control console trans-

INDIVIDUAL store air conditioners cool year 'round, in winter return water to heat pump system for heat extraction



BATTERY OF PUMPS used to deliver water through shopping center. Pumps move water in various patterns: from wells to court ventilating units, from individual air conditioners to court units (winter), from heat pump to coils in Dayton's store, from wells to various units for condensing purposes, from gas engines to perimeter units

cribes half-hourly readings from a variety of points to maintain a constant record of operating and environmental conditions at all times.

After Five Years . . .

First-cost economy was the principle reason for installing a heat pump system at Southdale. An approximate 35 percent saving in first cost was effected with this design, over the cost of a conventional system to do the same job. Operating costs were expected to be somewhat higher, but several seasons operation have indicated that running expense is comparable to that anticipated with the conventional design. In 1959, minimum air conditioning charges to tenants equaled 26 cents per sq ft. In 1960 this rose to about 29 cents, chiefly due to increased labor costs. Currently, tenants pay from 29 to 42 cents per sq ft for air conditioning, depending on space allotment. This cost includes winter heating plus a 15 percent markup for administration expense.

Tenants are charged four items: rent, common costs (guards, snow removal, etc.) air conditioning operation and air conditioning standby. The last is to amortize the heat pump and related equipment (including packaged units) over a 15 yr period.

Alternate Well Plan Is Effective

Though the well system is not operating as originally intended, it is still considered a good design feature. Calculations indicate that as first conceived, the plan would allow enough heat to be stored in

TABLE 1 — **SELECTED READINGS** of air conditioning system temperature and flow values for two consecutive days each, summer and winter, at peak load times (2 PM summer, 2 AM winter) give indication of system operation using heat pump, engine heat, packaged air conditioners, ventilation system

	Summer, Day 1, 2 PM	Summer, Day 2, 2 PM	Winter, Day 1, 2 AM	
Deep well No. 1, F	51	51	50	52
Deep well No. 2, F	51	51	51	53
Chiller water in, F	46	46	49	48
Combined chiller water out, F	37	38	45	43
Supply 1 and 2 leaving air, F	58	62	72	74
Garden court temperature, F	75	74	69	69
Supply 3 intake air, F	86	85	66	67
Supply 3 leaving air, F	61	63	91	105
S1 heat-cool coil leaving water, F	56	57	88	87
S2 heat-cool coil leaving water, F	55	62	79	96
S1 and S2 supply water, F	48	49	103	121
S1 and S2 heating return, F	54	57	97	91
Heat exchanger No. 1 condenser water out, F	64	67	89	84
Heat exchanger No. 2 engine water out, F	151	171	177	180
Heat exchanger No. 2 system water in, F	81	83	106	111
Heat exchanger No. 2 system water out, F	5	68	121	131
Water to engine jackets, F	172	172	176	176
Water from engine mufflers, F	274	274	174	177
Heat exchanger No. 5 engine water out, F	149	170	162	162
Snow melting glycol supply, F			98	109
Snow melting glycol return, F			66	76
Perimeter heating supply, F	85	86	103	131
Perimeter heating return, F	82	83	97	115
Central condenser water in, F	60	63	97	119
Central condenser water out, F	68	71	101	122
Heating return mixture, F	68	70	97	116
Central condenser return mixture, F	67	70	100	119
Outside air, F	89	88	6	—7
From deep well No. 1, gpm	375	411	444	444
From deep well No. 2, gpm	947	575	361	
Water to roof, gpm	480	550	290	340
Total air conditioning water, gpm	830	880	10	10
Ventilation water, gpm	690	1250	240	250
Building heating water, gpm	764	746	775	772
Chilled water, gpm	2850	2710	1350	1360
Propane gas, cu ft per hr	730	650	4440	4440
Natural gas, cu ft per hr	600	200	600	500
Central condenser water, gpm	1200	640	1200	1200
Engine jacket circuit, gpm	444	444	500	618

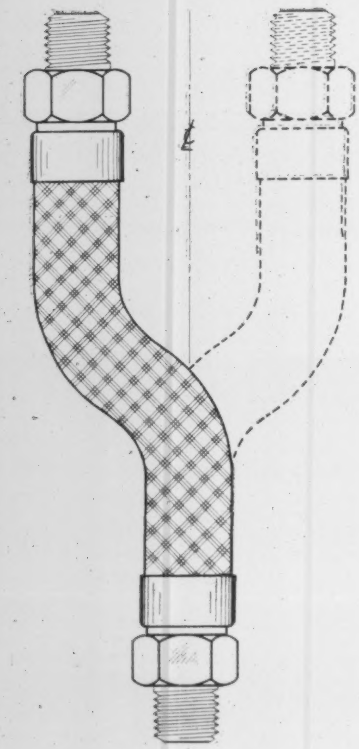
the reservoir in about three years to raise the ground temperature to a point high enough to hold the water temperature until it was used.

The heat pump has worked well, however, even without the storage feature. While there would be a saving using 60 F water from the reservoir instead of 50 F well water, it is estimated that it would cost more than that saving to eliminate the iron deposit on equipment. The deep return well is maintained as a standby. Waste water is now delivered to a nearby pond which flows into a creek, obviating the need for a return well.

Engineers are well pleased with the systems' overall operation. Dayton's store is to be enlarged so that the total Southdale floor area will exceed 1 million sq ft. To meet this increase, it should only be necessary to add one more engine and compressor for the heat pump, plus changing the deep diffusion well to supply well by the addition of a pump.

Southdale manager William Crear has stated that if the center were to be built tomorrow, a heat pump system would "without question" be chosen. ‡

Photos and tabular data courtesy Minneapolis-Honeywell Regulator Co.



The use of flexible metal tubing (hose) in piping systems to help solve problems of pipeline motion, vibration, misalignment, etc., is well established, but here are some points which the designer and/or installer should keep in mind when considering such devices. These ideas will help the engineer to get the most from the connectors, and the most from the piping system.

Flexible Metal Hose, Properly Used, Can Take the Strain Out of Piping Problems

FLEXIBLE METAL TUBING (or hose) is intended to solve problems of pipe movement — vibration, relative motion, misalignment, temperature fluctuation, space restrictions, and others. Basically it is leakproof metal pressure tubing with flexibility built in by means of a continuous series of corrugations.

Although "metal hose" and "flexible metal tubing" are often used interchangeably, the following are generally accepted as correct descriptions:

Metal hose is considered as being of relatively longer length, able to bend and flex in a hose-like fashion. The inner core of corrugated tubing may be used bare for low pressures, or overbraided for higher pressures. Braiding does not decrease flexibility, since it is designed to bend with the hose. *Flexible metal tubing* is a term usually applied to relatively shorter lengths of hose.

Flexible pipe connectors are shorter sections of tubing, with integral end fittings or flanges for connecting to the pipeline. *Flexible metal hose connectors* are the same units in longer lengths.

Ails and Cures

Vibration can be a real equipment killer. In the midst of the present trend toward the use of vibration damping and absorbing devices, engineers sometimes overlook the fact that the pipeline is the best conductor of any residual vibration. Also, equipment which is practically vibration free when built may no longer be that way after installation. Flexible metal pipe connectors, installed between the vibration source and pipeline, can cure this difficulty.

Changes in temperature cause metals to expand and contract, and flexible metal hose can frequently be used as an expansion compensator in lieu of space-taking loops and other geometric configurations.

Sometimes, when pipe is installed "from both ends," obstructions or other difficulties may keep the line from meeting exactly in the middle. Compensation for misalignment may be provided by a flexible pipe connector.

Provision for relative motion between components is often a good idea. For instance, when packaged boilers are used, and frequent cleaning of spinner cup burners is expected, the burner assembly may be hinged for easy access if the connection is to a length of flexible metal hose instead of to an inflexible line.

Construction Principles

Corrugated tubing is made from seamless pressure tubing, with corrugations formed close together. Each can flex slightly, with a cumulative effect that enables the tubing to bend. No packing is required because of the one-piece construction.

Since corrugated tubing has a natural tendency to extend, or straighten out, under internal pressure, it is often covered with one or more wire braids, anchored at both ends. The strong metal wires are tubularly braided in a basketweave, and the finished covering is designed so that the tubing can safely be used up to its full pressure rating without elongation. An additional covering of interlocked steel or synthetic material may be used to protect the braid.

Material Variety

Flexible tubing may be of stainless steel, Monel, carbon steel, or bronze, in common pipe sizes up to 24 in. Normally, the braid is of the same material as the tubing, although this may be varied. Some flexible pipe connectors are made, for instance, of stainless steel tubing for corrosion resistance, but with a less expensive outer galvanized steel braid.

Any desired end fittings or flanged construction are available, including male and female pipe threads, unions, flanges, flare tubes, quick-disconnect fittings, welding stubs, and elbows. Most commonly used connectors have male pipe threads and flanges. In the larger sizes (over 2 in.) the end fittings are usually ASA flanges. Flanged units should be selected with one fixed and one floating flange. This eases proper mating of bolt holes without imposing torque. Also, screwed units can be installed more quickly if the male pipe threads are equipped with a hex surface for wrench grip.

Flex Limitations

Metal can expand, but only so far without rupturing. Similarly, flexible metal tubing can bend only within fixed limits. In service, the tubing is subject to a number of basic motions:

Permanent Bends

These are static bends formed to facilitate alignment of two pipeline components. There is a minimum recommended radius for each pipe size, and to exceed this limit is to invite early failure.

The term "minimum bending radius" is often misunderstood. Most manufacturers furnish two values. One is for "free flexing" — this is the point to which a hose can be bent or flexed repeatedly. The second value is for permanent bend, and is usually smaller than the first. A good rule of thumb is that the permanent bend radius should be no less than 2½ times the outside diameter of the hose.

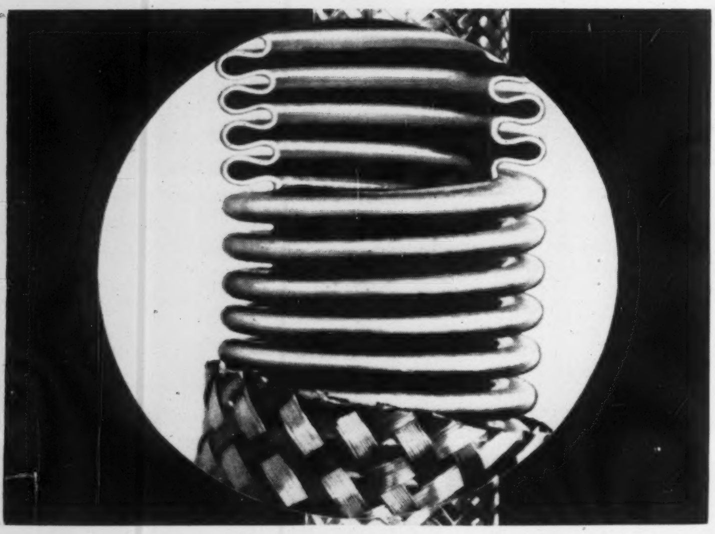
Offset Motion

This is movement in which the free end of the flexible tubing remains parallel to the fixed end, but with its axis shifted. It is sometimes called lateral, transverse, or parallel offset motion.

Some other stress-imposing action to which the connectors can be subjected includes radial motion (generally found in traveling loops), random motion (in all manual uses of flexible tubing), and axial motion (where all movement occurs along an axis).

Competent technical advice on the selection of a particular connector is especially important when more than one condition is present. Restrictions on the use of

DON'T bend flexible pipe connectors too close to end fitting, since joint between fitting and tubing is weakest part of unit



TWO-PART construction of flexible metal hose consists of corrugated tubing plus outer covering of braided wires. Braid is sometimes omitted on low pressure units

connectors in regard to the limitations indicated above should be available from the manufacturer of any connector.

Application Suggestions

The problems which call for more flexibility than the "solid" pipeline can provide will generally be obvious to the design engineer, and it is common practice today to consider the use of flexible connectors in solving these difficulties. There are, however, a number of notions on application which the engineer will do well to keep in mind.

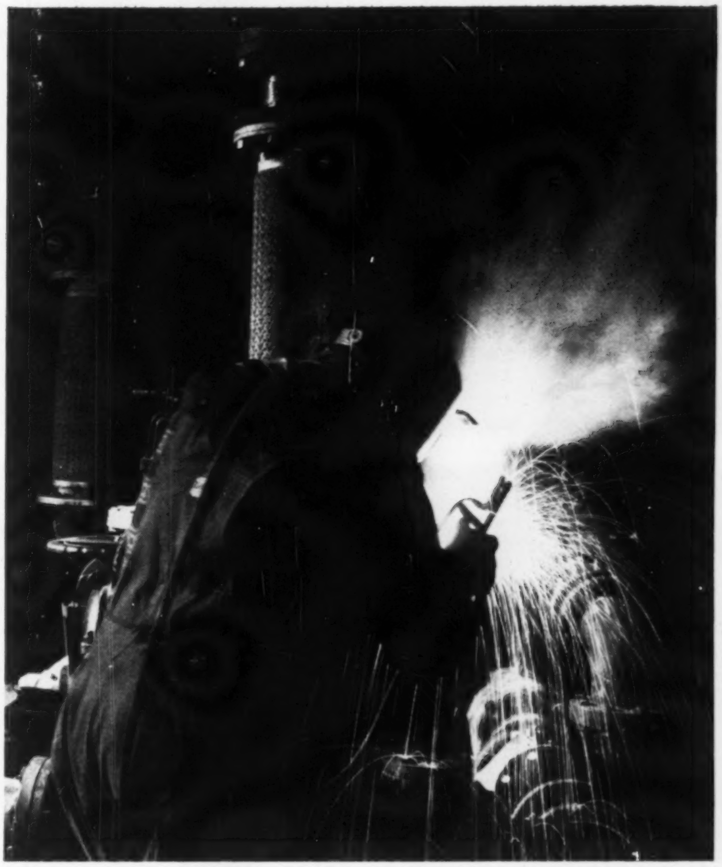
For instance, compressors tend to vibrate more than pumps, and therefore require longer connectors and more careful installation. A pump connector should never be used on a compressor. Also the greatest compressor vibration will occur at startup and shutdown. This "excess" vibration can be considerable, and tubing must be long enough to absorb all "whipping".

Riser Connections

There is a tendency in new construction to use large risers carrying hot water from basement to roof, with horizontal take-offs at each floor. As temperature fluctuates, the riser will expand longitudinally, and it is essential that flexibility be provided in each branch to prevent destruction of the piping system. Also on hot water installations, copper tube

ALWAYS use two wrenches when installing connectors to avoid torque damage

DON'T risk damage to outside wire braid by welding too close to connectors without providing adequate non-flammable shield protection



baseboard radiation is frequently used, and such tubing expands and contracts with temperature changes. Flexible metal connectors can serve well here, especially where tight corners or obstructions present additional problems.

Increase Service Life

Flexible metal tubing (and hose) is a specialized piping system component which is designed to do a specific job. Fabricated of relatively thin wall tubing, it cannot take as much abuse as pipe of the same nominal diameter. Within such limitations, and if properly selected and installed, it will give excellent service, as will any other quality engineered product.

Most common failures can be prevented. Careful attention to the following details will go a long way toward increasing the effective service life of the connector.

Pressure

When calculating the anticipated line pressure, one must also take into account possible overpressures, surges, pulsating and shock conditions, and any increased pressure due to elevated temperatures. Are there quick-closing valves in the line?

For use under pulsating and shock conditions, even when intermittent, stronger units must be selected. Units for pulsating pressures should be chosen on the basis of double the equivalent static pressure, and for shock pressures six times the static pressure.

When Braid Is Needed

When pressure and vacuum both occur in the same line, a braid is generally required. For vacuum only, or for very low pressures, flexible tubing alone may suffice.

Some cast fittings may suffer from a certain amount of porosity, and the same applies to the braze or weld at the fitting. A very slight degree of porosity may be permissible for most installations, but it can represent a future source of trouble because corrosion, if it occurs, will start here.

Searching gases and vacuum are particularly critical. Searching gases will seek out the most minute porosity, and even a slight vacuum has a nasty habit of admitting air.

To avoid these complications, the engineer should demand that all connectors be tested (under water) and when intended for use with vacuum or searching gas, that the test be conducted with nitrogen or helium under water.

Temperature

The strength of both tubing and braid will decrease as temperature increases. Table 1 is an itemization of reasonable pressure limitations to be expected of flexible connectors of various sizes and materials. Table 2 gives correction factors to be applied to the values of Table 1 for increased temperatures. The combined pressure-

TABLE 1 — OPERATING PRESSURE LIMITATIONS for standard flexible pipe connectors vary as shown here. Values apply to braid material because braid restrains hose from expanding under pressure, and is weakest component of the connector. Figures are based on temperature of 70 F. Apply correction factors from Table 2 for higher temperatures. See other qualifications below

Nominal pipe size, in.	Braided hose pressures, psig			
	Bronze	Monel	Galv. steel	Stainless
¼	1100	1200	1300	1850
⅜	800	900	1200	1700
½	600	750	800	1375
¾	500	725	750	1300
1	450	500	550	975
1-¼	350	400	450	900
1-½	300	375	400	675
2	250	275	300	550
2-½	200	275	300	500
3	150	250	275	375
3-½	150	190	200	300
4	125	150	175	250
5	125		230	300
6	100		200	250
8	75		150	200
10	50		100	150
12	25		90	125
14			75	100
16			50	75

Values are based on static pressure. For *pulsating pressure* multiply by 0.5; for *shock pressure* (or water hammer) by 0.7

Table is based on safety factor of 4:1. Some codes may require additional allowance. Three to one may be acceptable for low pressure. To change safety factor, multiply as follows: For 5:1, by 0.80; for 6:1, by 0.65; for 3:1, by 1.33

TABLE 2 — CORRECTION FACTORS to be applied to the working pressures in Table 1 to compensate for increase in line temperature above 70 F. Figures apply to braid material for braided hose units; to hose material for unbraided units

Temperature, F	Material			
	Stainless steel	Bronze	Monel	Carbon steel
100	99	98	98	100
150	96	93	93	98
200	94	90	90	97
250	92	87	87	95
300	89	84	84	93
350	86	82	82	90
400	84	78	78	87
450	82	76*	76	84
500	79		73	81
550	76		70	78
600	74		67	74
650	72		64	71
700	70		61	67
750	68		58*	63
800	66			58*
850	64			
900	63			
950	61			
1000	59			
1050	57			
1100	54			
1150	52			
1200	50*			

*Maximum normally recommended operating temperatures (depending on material in either braid or hose) are: stainless, 1200 F; bronze, 450 F; Monel, 750 F; and steel, 800 F

temperature value should always be used.

Combined Forces

Special care must be exercised when a combination of circumstances are present to restrict the selection of these units. For example, if a flexible connector is capable of absorbing ½ in. vibration OR 1 in. lateral offset movement, and both vibration and offset occur simultaneously, a 50 percent allowance should be made in both values, and a longer connector used.

At least a 4 to 1 safety margin should be included in the design. Some codes require a safety factor of 5 to 1.

Don't "Shortchange"

There is sometimes a temptation to install a shorter-than-recommended length. Don't. Installation of a too-short unit is false economy and dangerous. It may fail prematurely and have to be replaced with one of the proper size. Failure can damage other equipment, and a sudden rupture could endanger personnel.

Flexible metal hose constitutes a compromise. The tubing wall must be sufficiently heavy to withstand pressure, abuse, and corrosive attack, yet thin enough to offer flexibility. When stretched beyond its original length, excessive residual stresses are placed on the hose, braid, and fittings. The net result is early rupture and costly replacement.

Proper Placement

These units are designed to absorb only those stresses which are perpendicular to the axis. Therefore they must be installed at right angles to the anticipated movement. To effect this, it may be necessary to install two flexible metal hoses at right angles to each other in some instances.

On vibrating equipment, the

flexible components should be placed as close as possible to the source of vibration to assure the best possible job and long service life.

Valve Goes Downstream

Always install connectors *between* equipment and valves. Other procedures can result in premature (and sudden) failure.

Appreciable forces are often generated in pipelines. Piping may whip from transmitted vibration unless it is securely anchored immediately *following* the flexible connector. That is, anchors should be placed at the outboard end of the connector (away from the source of vibration) and must be strong enough to withstand the vibration and pipeline movement.

Multi-Plane Forces

A flexible hose should never be flexed or vibrated in more than one plane, because such action imposes torque and shearing stresses which will reduce expected life considerably. Where this kind of installation is necessary, the connectors should be pre-bent (with braid added after) to keep the hose free of torque and the braid fitting properly. ⌗

Do's and Don'ts with Flexible Connectors

Measure carefully to find the required connector length, then install the unit at its exact normal length. Avoid compressing or stretching.

Line up bolt holes before welding pipe flanges. A floating flange on one end of the connector will ease installation.

Always use two wrenches to prevent torque when a flexible connector joint is being made up.

Anchor the flexible unit securely at the piping end — NEVER at the equipment end.

Restrict motion to a single plane. Use pre-bent units to handle multiple bends.

Avoid short radii and S-bends.

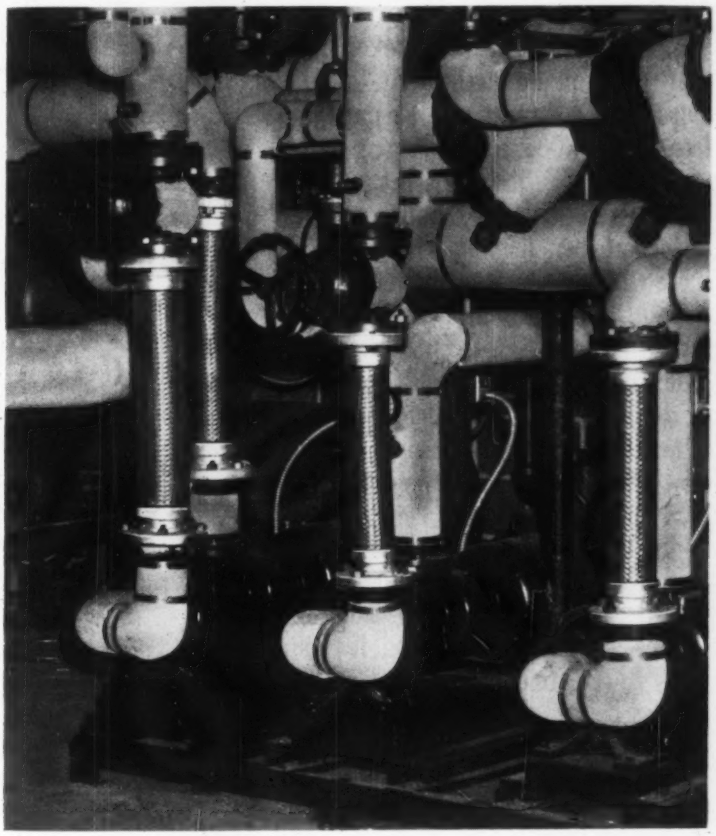
Keep fitting ends or flanges parallel.

Don't exceed the maximum listed offset.

Use hangers so that no weight is carried by the connector.

Protect outer braid with non-flammable material when welding.

NEVER put valves between flexible metal hose and equipment.



BE SURE that flexible connectors are always installed *between* equipment and valves. Piping should be anchored immediately following connector, away from the source of vibration

The editors are pleased to acknowledge the cooperation of Allied Metal Hose Co. in supplying data and illustrations for this article.

Maintaining a Controlled, Pressurized Environment in a Radome

Mechanical engineering makes its contribution to our age of technology in a variety of ways. Here it helps get the best possible service from radar antenna installations.

Flexible spherical radomes enhance radar transmission efficiency and cause less beam distortion than do rigid enclosures, but suffer more from high wind loads. Exact interior pressurization with ultra-clean and conditioned air is needed — just enough to resist wind loads; not enough to expand or distort the fabric. Here's how it's being done.

Mr. Green is a graduate of City College of New York and is a registered professional engineer in New York and Pennsylvania. His 25 years experience in air conditioning has included in recent times a variety of space age projects. He was principal mechanical engineer for the SAGE system facilities, the joint Army-Navy DAMP project, and the NIKE-ZEUS project, besides being the supervising engineer for the USA Cold Regions Engineering Laboratory and Cosmotron Research Extension, Brookhaven National Laboratories.

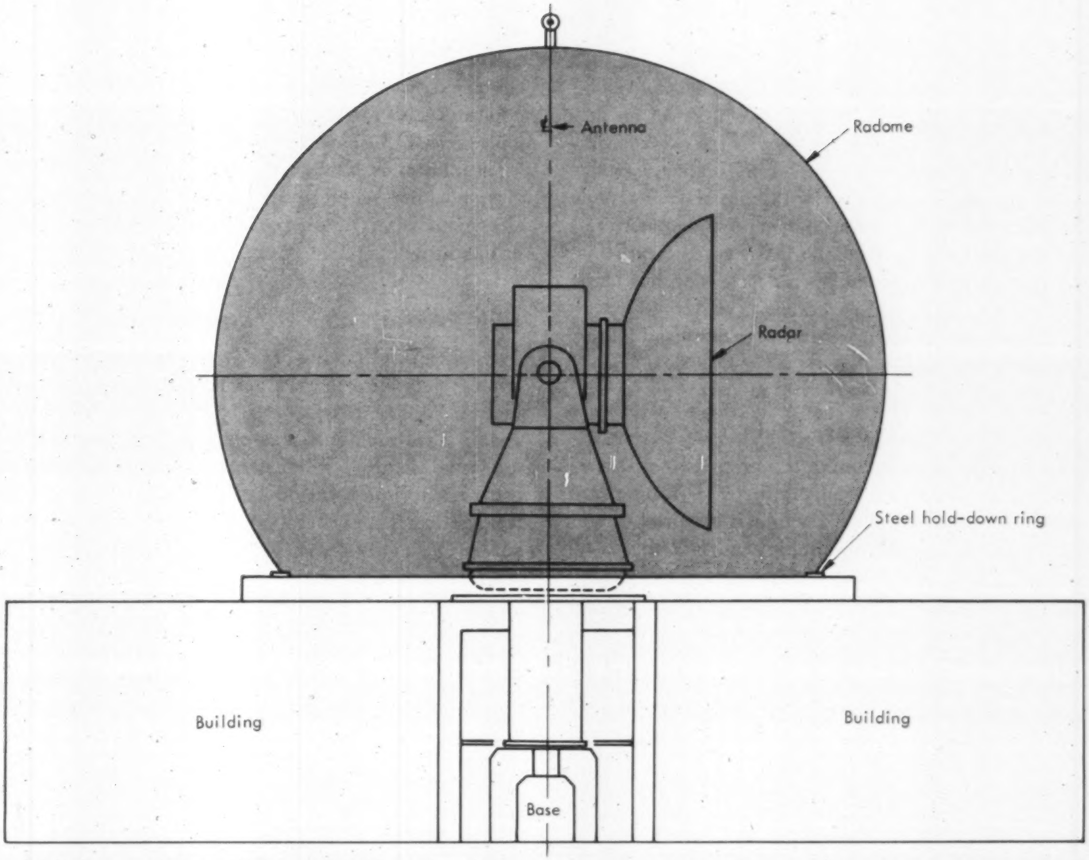
By PHILIP A. GREEN
Chief Mechanical Engineer
Pope and Evans
Consulting Engineers

EXPERIENCE at early installations of large radar antennas indicated that protection against wind, snow and ice loads was required to assure satisfactory operation. The heavy structural framework required in conventional rigid-type radomes to resist high wind loads often resulted in poor radio frequency transmission efficiency and excessive beam distortion. A light radome enclosure was required that would provide adequate protection against the elements while not interfering with wave propagation or with reception.

Developing an Improved Radome

Spherical, air-supported radomes were first suggested to the Air Force by Cornell Aeronautical Laboratory in 1946. An airtight, coated fabric was developed and a prototype air-supported radome was built to test the soundness of this design. Tests proved the concept to be highly successful and many such enclosures have been employed with equal success since that early installation.

The radome described in this article has just re-



1 TYPICAL RADOME INSTALLATION, as described in text, consists of 47 ft diameter coated fabric sphere secured to concrete base by steel hold-down ring. Concrete serves as access floor and supporting structure for transmitter and receiver. Problem was to air-support dome with just enough pressure to withstand wind, yet not force air through fabric

cently been completed. For security reasons identification of the radome and its location are withheld. This 47-ft-diameter, air-pressurized unit will maintain a clean and controlled environment for both the electronic apparatus and the radar equipment.

Dome, Structure Are "One"

The principal feature of the radome is a coated airtight fabric which is inflated to a spherical shape and fastened to a concrete base by a steel hold-down ring. This concrete base serves as an access floor and supporting structure for the transmitter and receiver. Auxiliary electronic equipment is housed below the radar equipment. A typical configuration for a target tracking radar installation is shown in Fig. 1.

Determining Proper Internal Pressure

Air pressure within the radome is maintained by a system carefully engineered to assure complete reliability, as any failure could cause the radome to collapse. Such an accident would very likely damage the expensive electronic equipment or, even more serious, produce a prolonged outage at a critical period.

Limit Pressure At Both Extremes

To avoid the possibility of a failure due to external high wind pressure, the internal design air pressure must be just high enough to withstand the external wind forces. For example, a design pressure that is excessively high will not add to radome stability but merely increase the amount of air leakage and the power requirements. Overpressure will also materially decrease the life of the radome since the fabric deteriorates with time and the rate of deterioration varies directly with the internal air pressure. In addition, overpressures will gradually cause the radome diameter to increase. Consequently, the lowest acceptable design pressure had to be selected. The relationship between design pressure and wind velocity is shown in Fig. 2.

Accounting for Variable Winds

At this facility, provision has been made to vary the internal air pressure according to the force of the external winds. The pressure controller is normally set to a value determined by the expected wind velocity. A decrease in wind velocity has no effect on the control point setting. In the event of a windstorm, however, the internal air pressure is automatically raised by the controller to withstand the effects of the storm. After the storm, the operator manually resets the control point to its normal setting. Since this is a prototype installation, special provision has been made in the design of the radome to withstand external pressures equivalent to a wind velocity as high as 150 mph.

Controlling Temperature, Humidity

In addition to maintaining the proper air pressure within the radome, the temperature and relative humidity must be controlled. Cooling is required to absorb both the internal electronic load and the solar radiation. In a desert area, with a clear dry climate and sand reflection, the external heat load will be extremely high and may approach a value of 200 Btu per sq ft on the radome sphere.

For most radar installations the temperature within the radome should be between a maximum of 100 F and a minimum of 50 F. At this installation, this particular temperature range was chosen to permit servicing of radar equipment as soon as possible after shutdown. Without air conditioning, the massive equipment would tend to maintain equilibrium temperatures above the comfortable working range for long periods of time after shutdown.

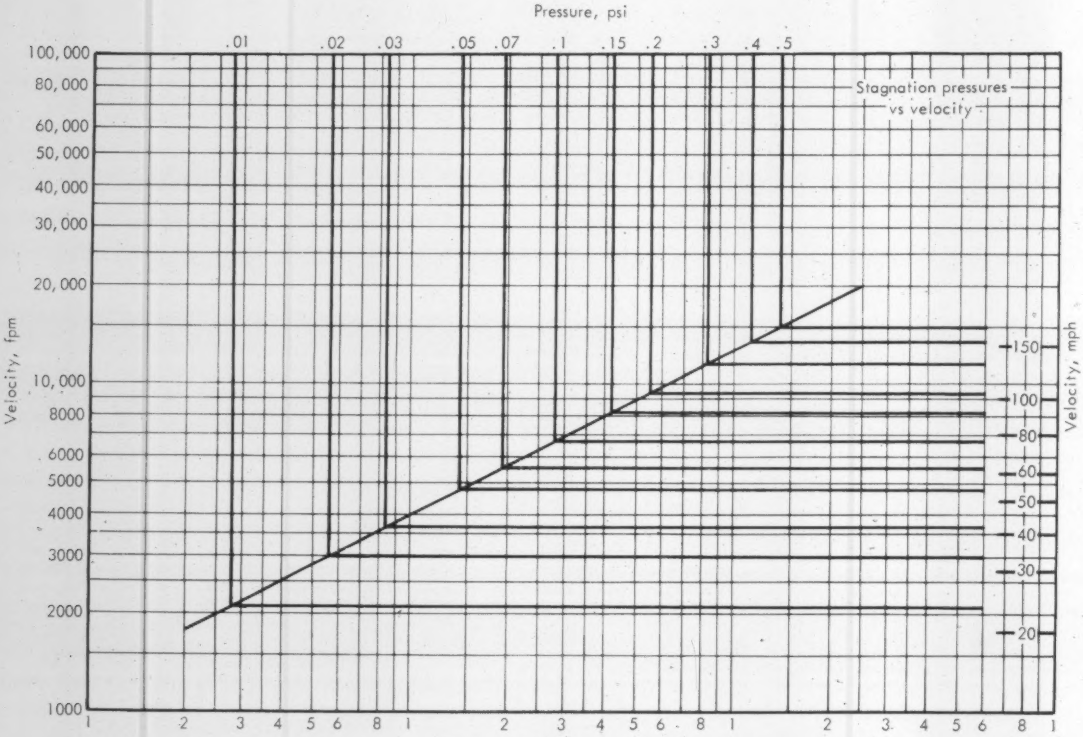
Cleanliness is also an important factor in the environment for radar equipment. Therefore, high-efficiency air filters and pre-filters have been included in this installation.

How Pressurization Is Accomplished

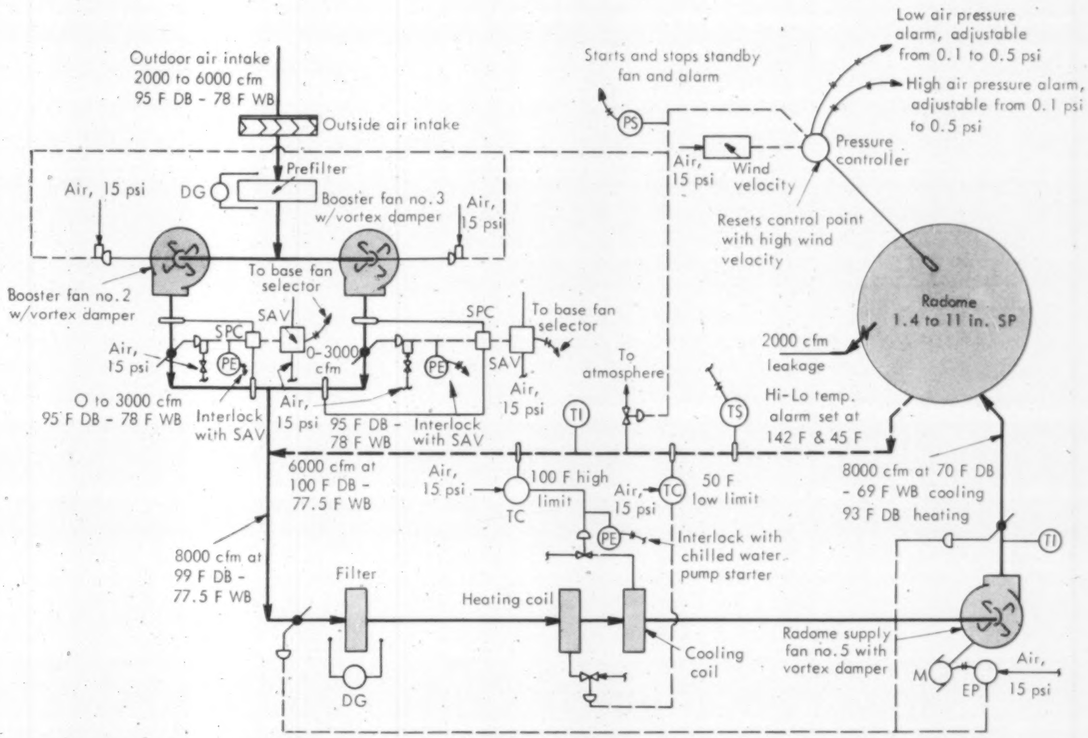
A schematic drawing of a typical radome pressurization system for a target tracking radar unit is shown in Fig. 3. This system consists of two major components: a recirculating component, which includes all air conditioning equipment, and a pressurization component, which introduces sufficient air to offset leakage losses and maintain the predetermined pressure.

Control Is By Return Air Thermostats

The air temperature in the radome is controlled by two thermostats, *TC-1* and *TC-2*, located in the air stream returning from the radome. Thermostat *TC-1* limits the return air temperature to a maximum of 100 F by throttling the chilled water valve. Thermo-



2 INTERNAL PRESSURE-WIND VELOCITY RELATIONSHIP illustrated here is critical to design of radome pressurization and air conditioning system. Too much pressure won't add to dome stability, but will cause excessive air leakage, decrease fabric life, and eventually distort sphere


Outdoor air intake
2000 to 6000 cfm
95 F DB - 78 F WB
Outside air intake
Prefilter
Air, 15 psi
DG
Booster fan no. 3
w/vortex damper
Air,
15 psi
To base fan
selector
Booster fan no. 2
w/vortex damper
SAV
SPC
Air,
15 psi
PE
0-3000
cfm
SPC
To base fan
selector
SAV
PE
O to 3000 cfm
95 F DB - 78 F WB
Interlock
with SAV
Air,
15 psi
95 F DB -
78 F WB
Interlock
with SAV
Air,
15 psi
To
atmosphere
TI
TS
6000 cfm at
100 F DB -
77.5 F WB
Air,
15 psi
100 F high
limit
TC
Air,
15 psi
TC
50 F
low limit
PE
Interlock with
chilled water
pump starter
8000 cfm at
99 F DB -
77.5 F WB
Filter
Heating coil
DG
Cooling
coil
Starts and stops standby
fan and alarm
PS
Air,
15 psi
Wind
velocity
Pressure
controller
Low air pressure
alarm, adjustable
from 0.1 to 0.5 psi
High air pressure alarm,
adjustable from 0.1 psi
to 0.5 psi
Resets control point
with high wind
velocity
Radome
1.4 to 11 in. SP
2000 cfm
leakage
Hi-Lo temp.
alarm set at
142 F & 45 F
8000 cfm at 70 F DB
- 69 F WB cooling
93 F DB heating
TI
Radome supply
fan no. 5 with
vortex damper
M
EP
Air,
15 psi

3 PRESSURIZATION-CONDITIONING SYSTEM is integrated but separately controlled for the two functions — by return air thermostats (100 F max., 50 F min.) for temperature, and by differential static pressure control across booster fans. Isolation dampers prevent air flow from radome in case of fan failure

stat *TC-2* limits the return air temperature to a minimum of 50 F by throttling the hot water supply to the heating coil.

The vortex damper on circulating fan No. 5 plus the automatic bleed valve provide for simple adjustment of the fan's air capacity. Two air-operated butterfly valves located in the supply and return air ducts above the air conditioning equipment permit routine maintenance to the equipment without depressuring the radome.

The pressurization system includes the two booster fans (one of which is on stand-by) and their associated vortex dampers, isolation dampers and controls. In normal operation, a pressure controller regulates the position of the air-operated vortex damper located on the inlet side of the operating circulating fan to maintain the predetermined radome air pressure.

Protection Against Fan Failure

If the pressure should continue to rise with the vortex dampers completely closed, the automatic bleed off valve will bleed sufficient air from the system to maintain the required pressure. Both controls are required due to the wide variations of air capacity required for all operating conditions.

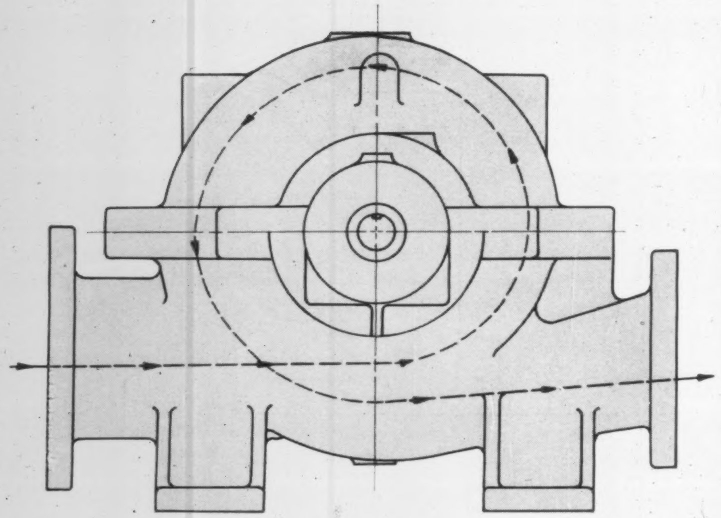
If the operating booster fan should fail, the pressure within the radome would decrease, causing a pressure switch to close which would in turn automatically start the stand-by fan and energize a signal to inform the operator that a fault had occurred.

With the failure of the fan, air flow across the isolation damper associated with the faulty fan would cease. At the same time the static pressure controller would automatically cause the isolation damper to close to prevent the air from reversing its flow through the fan unit and escaping outside. In the meantime, the static pressure controller associated with the fan on stand-by would be immediately activated and its isolation damper would open to permit air flow into the radome.

It is also possible for both fans to be activated for simultaneous operation if additional capacity is required to maintain the internal pressure. Such additional capacity may be required in the event of a large puncture (200 sq in.) of the radome fabric.

Maximum Safeguards

The measurement of differential static pressure across the isolation damper has been selected as the method which would best determine when a fan failure has occurred. This differential pressure reading also prevents the isolation damper from opening until static pressure on the fan side is greater than pressure in the radome, assuring that the direction of air flow will always be into the radome. ≠



How Performance Curves Help You Select Centrifugal Pumps

By HAROLD W. WOODHOUSE
Assistant Professor
Mechanical Engineering Department
Stevens Institute of Technology

Knowing exactly the meanings of the various performance curves which illustrate the phenomena of centrifugal pump operation will aid the engineer in selecting and using the proper pump for his particular job.

Mr. Woodhouse continues the series begun last month[1] aimed at a better understanding of pumps and systems — and a decrease in the number of disappointing installations.

---

[1] *A Guide to Selecting Centrifugal Pumps*, Heating, Piping & Air Conditioning, October, 1961

A TYPICAL centrifugal pump performance curve (Fig. 1) would show

1) The head-capacity curve,
2) The brake horsepower curve,
3) The efficiency curve, and
4) The net positive suction head curve.

Let us briefly consider each of these.

Head-Capacity Curve

This shows the head which the pump will develop at any capacity. An important point to remember is that the pump *must* operate somewhere on this curve. For a specified speed, it cannot operate at any point above or below the curve without some physical change to the pump itself.

Brake Horsepower Curve

Pump manufacturers run standard tests with water as the pumped fluid, and therefore their test values will be predicated on a specific gravity of 1.0, and if a pumping system is designed to handle, say, gasoline, of specific gravity 0.75, then a second brake horsepower curve for this specific gravity should be shown.

Fig. 1 shows one brake horsepower curve for a specific gravity of 1.0 and another for 0.75, and therefore the ratio of the ordinates y' and y will be

$$y'/y = 0.75$$

This conforms to the rule which states that the power required to drive the pump will be proportional to the specific gravity of the fluid which is being moved.

Efficiency Curve

This is calculated from values of head, pump capacity, water horsepower, and brake horsepower, and represents the ratio of power required to do the work at 100 percent efficiency to that actually required because of inherent losses. Some efficiency factor is applicable, of course, to all machines.

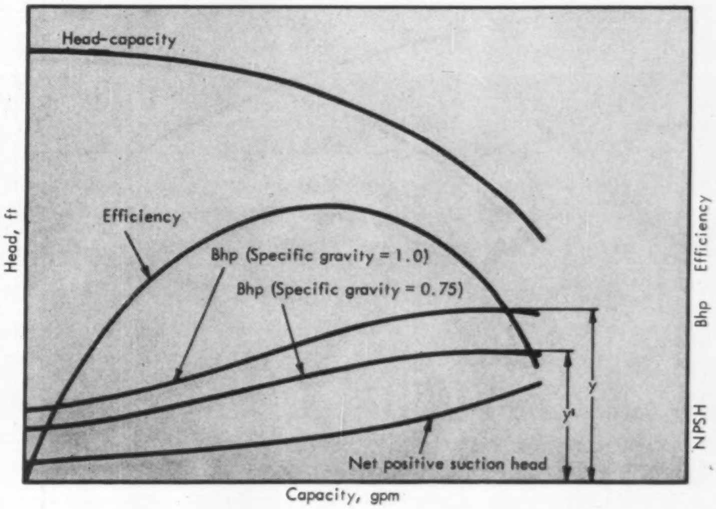
NPSH Curve

The net positive suction head curve may or may not be included in a set of general performance curves. Sometimes it is of no consequence, and sometimes it is all important. Generally speaking, for any one application, if the pumped liquid is cool and a gage *at the pump suction flange* shows a positive pressure, then the net positive suction head is of no consequence. This will be true for standard commercial speeds with about 3600 rpm as the maximum. There are certain special turbine-drive pumps in the 8000 to 12,500 rpm class where even a slight positive pressure at the pump suction might not guarantee freedom from cavitation which results from insufficient net positive suction head. The whole subject of NPSH will be discussed in more detail in the next article of this series.

What Is System Head?

As we said earlier, a centrifugal pump must operate somewhere on its head-capacity curve. Nowhere else. But where on this curve?

Assume the test curve of a particular pump to be in the form shown in Fig. 2. We know that when the pump is installed and running at full speed with the discharge valve fully closed (shutoff state) the head will be at the point marked "shutoff" on the curve, corresponding to zero flow. Then, as the discharge valve is opened, the head will move to some point along the curve which extends through *A* and *B*, un-



1 TYPICAL set of performance curves for centrifugal pump would include curves for head (capacity), efficiency, net positive suction head, and brake horsepower (plotted on basis of specific gravity of liquid pumped)

selecting centrifugal pumps

til, with the discharge valve fully opened, the head and capacity will stabilize at some point which we will call *B*. Now what causes the pump to operate at this particular point?

Reason: Total System Effect

The reason is that, in this instance, the *system head* and the *pump head* coincide when the capacity delivered by the pump is at point *B* on its performance curve.

The system head of a specific installation can be defined as the total dynamic head required to move a stated rate of flow through that system.

System head is the algebraic summation of the static head on the discharge side of the pump, *plus* the static lift on its suction side, or *minus* the static head plus all dynamic friction losses of all pipe and fittings on both suction and discharge sides, for the flow under consideration.

Curve Shows Head Coincidence

A typical system head curve is superimposed on Fig. 2. At zero flow, there will be no dynamic friction losses, so that the system head will be the static head plus the suction lift (or minus the suction head). This condition is at *S* ft of head, as shown in Fig. 2.

As flow increases through the system, the friction losses also increase, roughly according to the square of the flow, so that at some capacity point, *X*, the total system head requirement is *S* plus *PF* ft.

Assume that the pump being considered also develops a head equal to *S* plus *PF* and that this occurs at point *B* — which also is the location of capacity *X* on the system curve.

This Is Where Pump Will Operate

It now is apparent that the pump head-capacity curve and the system head curve intersect at the common point *B*-*X*, and that this is the only point common to both curves.

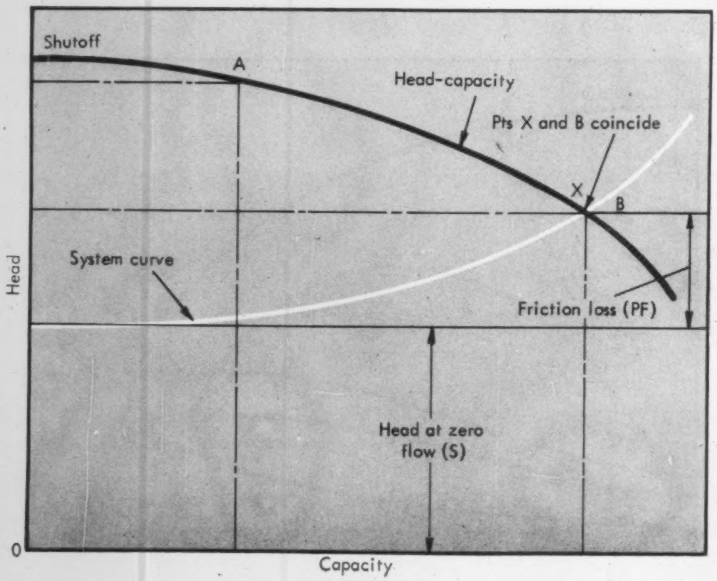
Without some physical change, this is the only point at which the pump will operate in this system, and the flow delivered will be in accordance with the location of the combined points *X* and *B*.

If the System Is Changed

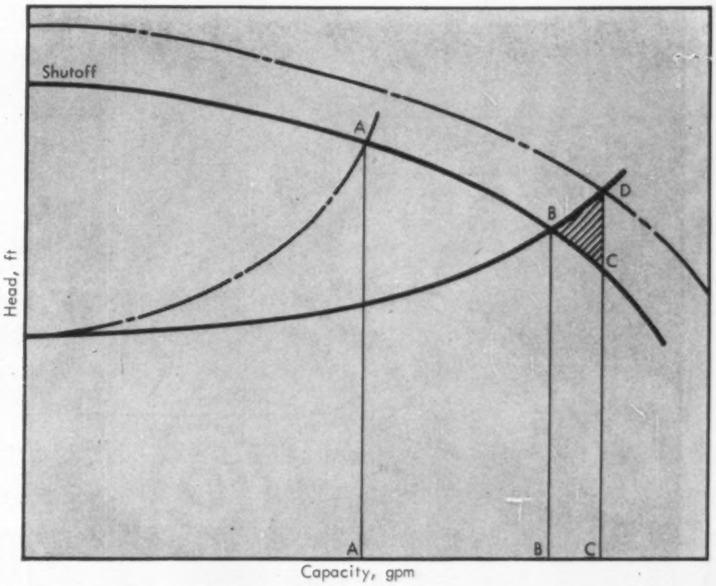
Suppose that with the same pump installation, a physical change is made to the system so that its frictional resistance is increased. Then the system head curve might intersect the pump head-capacity curve at *A*, as in Fig. 3, and the capacity at *A* would be the maximum flow the pump could deliver at this increased head. The change in frictional resistance of the system is

$$\text{Head}_A - \text{Head}_B$$

If we wish to reduce output capacity of the pump from *B* to *A* in Fig. 3, we will close the discharge valve until capacity declines to *A*. The effect of partially closing the valve is to increase artificially



2 TEST CURVE for particular pump includes point *B*, which represents full-open operation. System head curve (*white*) intersects pump curve at X (*B*), which is where pump will operate in this system



3 EFFECT of increasing system resistance against the pump of Fig. 2 is to move pump-system intersection back from *B* to *A*, which becomes new operating point. Increasing flow to *C* is impossible without decreasing system head or raising pump speed or changing impeller

the system head losses so that the system head curve passes through point *A*, by increasing the turbulence losses through the valve.

Can Flow Be Increased?

What if we'd like to deliver a capacity as represented by point *C* in Fig. 3? With the discharge valve fully open, we find that we can obtain the capacity corresponding to point *B*. What can be done about this?

While we can see from its test head-capacity curve that this pump, *at rated speed*, is capable of delivering capacity *C*, it can do so only against a resistance of head *C*. Extending the head system curve to capacity *C* we see that the head requirement increases to point *D*. There is, then, a deficiency of head put out by the pump against that required by the system of ($\text{Head}_D - \text{Head}_C$) ft. In fact, without a change in the system, the pump, at rated speed, could not operate anywhere in shaded area *BCD*.

Some Possible Solutions

Depending on the specific installation, the engineer may have several courses of action open which will permit operation at capacity *C*.

The simplest (if feasible) is to reduce the system head so that it will pass through point *C*. This might be achieved by fully opening intermediate valves in the system which had been partially closed. In old systems, much of the head loss might be due to severe constriction in the piping bore by deposits of lime. Cleaning or replacing the piping would alleviate this condition.

Another, not often too feasible an approach (it is costly) is to reduce system head by replacing small piping having a high velocity flow with piping of larger diameter.

Sometimes Speed Can Be Changed

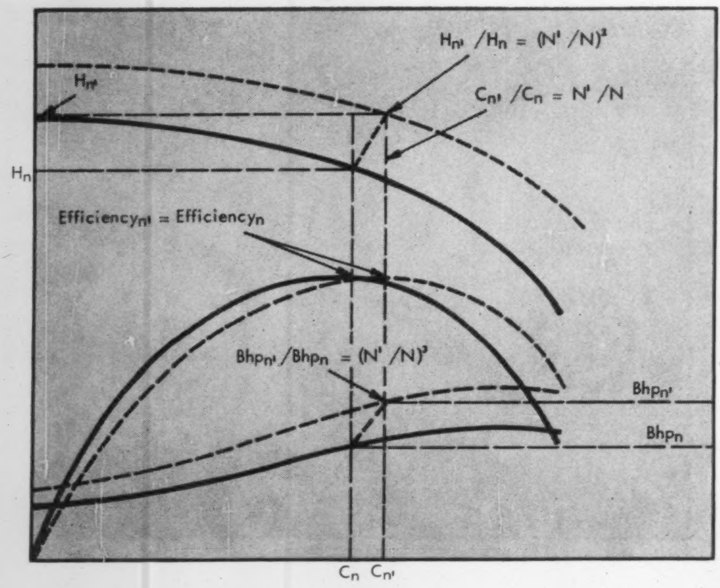
The operator might be able to increase pump speed so that it would develop a new head-capacity curve which would pass through point *D*, as illustrated by the broken-line curve in Fig. 3. Electric motor drive speeds are usually unchangeable, but such a solution may be possible with steam turbine drives, which allow for turbine speed changes over a wide range, usually with no or simple modifications.

If the driver speed only is changed, without any other change in pump or system, more horsepower will be required by the pump. This might be determined from a pump curve or calculated, since for such conditions of speed change only, the horsepower varies according to the cube of the speed over a moderate speed change.

Another Possibility: Impeller Change

Failing other means of increasing pump discharge head it is frequently possible to install a larger diameter impeller, or impellers. This also will increase required horsepower.

If a surplus of driving horsepower previously existed, the available horsepower with new, larger impellers might still be adequate. Some people solve the problem by seriously overloading the driver. This is fine only for the supplier of new drivers. An electric motor can talk back only by circulating an aromatic perfume of burning armature insulation (when it suffers the affliction of oversized fuzes or jammed



4 SPEED CHANGE (increase) from value at which test curve was run will result in changes to performance curves as shown here. Changes can be calculated so long as difference is not excessive

breaker cut-out) — the steam turbine is much more sensible, like a burro it refuses to work any harder than its normal rating plus a reasonable overload.

At any rate, the change required for a particular problem of increased head or capacity is not, in most instances, so radical that it cannot be solved in one of the ways suggested without going to the expense of a new pump.

Capacity Is Easily Determined

To determine the capacity of flow of a specific pump is a simple matter if a test curve for that particular pump (at its rated speed) is available.

The total dynamic head of the pump at any operating point will be the difference in readings between a pressure gage installed at the pump suction flange and another at the discharge flange. For accuracy, the gage readings should be corrected to the pump centerline and the difference in velocity head at discharge and suction added, but in all but low head pumps these correctives are minor.

By checking where pump head value falls on the test head-capacity curves, the capacity may be read directly. In Fig. 3, if the head corresponds to point *B* then the capacity is read directly below.

The Effect of Speed Change

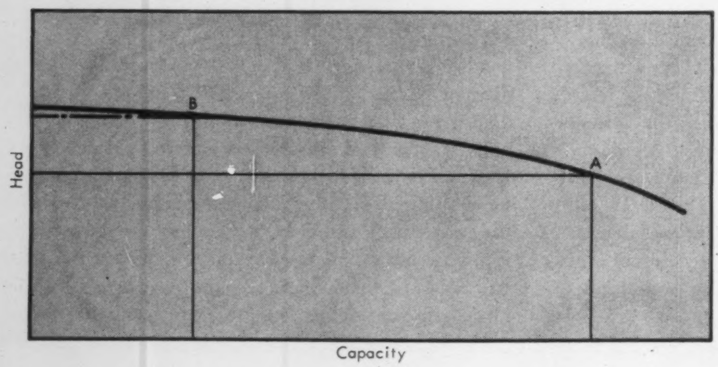
Suppose the pump doesn't run at the same speed as shown by its test curve? The curve may have been made at 1150, 1750, or 3500 rpm, whereas the pump actually runs at 1200, 1715, or 3600 rpm. Or the pump may have been purchased for 1750 rpm and a later decision made to increase driver speed to 2200 rpm. What about the new performance curve of the pump?

If N is the speed at which the test curve was run, and N' is the new speed, then at any selected capacity on the test curve

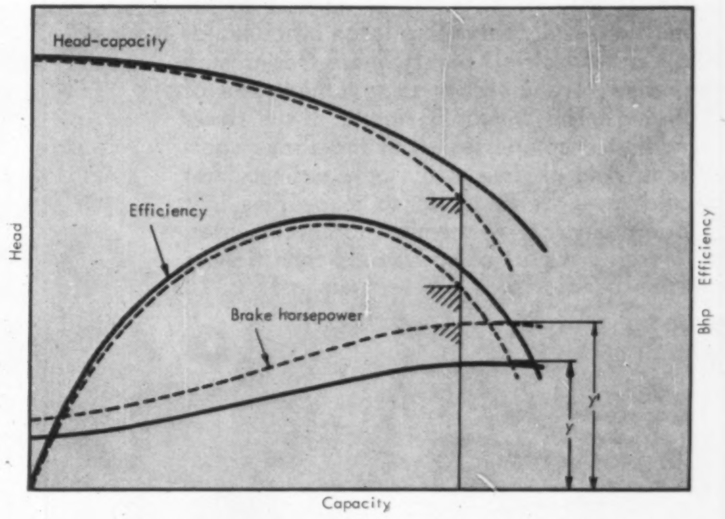
$$\text{New capacity} = \text{Old capacity} \times N'/N$$
$$\text{New head} = \text{Old head} \times (N'/N)^2$$
$$\text{New brake hp} = \text{Old brake hp} \times (N'/N)^3$$

The pump efficiency will remain the same.

All the foregoing regarding the effect of a speed



5 HEAD-CAPACITY curves for centrifugal pumps have common "falling" characteristic. As flow increases, head drops. This curve is "flat" — big change in flow produces only slight change in head



6 VISCOUS FLUIDS require changes in performance curves of nature shown here. Power requirement may be critical, since driver sized "on water" may be overloaded by more viscous fluid

change are approximate only, and are subject to correction for radical changes. For instance, because of the considerably increased hydraulic velocities, one might be disappointed in calculating anticipated performance at 3500 rpm on 1750 rpm tests.

Typical Problem, Result

Suppose the turbine drive pump which is to have its speed changed from 1750 to 2200 rpm develops 350 ft of head, 950 gpm capacity, and requires 116.5 brake hp for an efficiency of 72 percent when handling clear cold water at 1750 rpm. What will be the new conditions?

$$N'/N = 2200/1750 = 1.258$$

Therefore:

$$\text{New capacity} = (950)\ (1.258) = 1195 \text{ gpm}$$
$$\text{New head} = (350)\ (1.258)^2 = 552 \text{ ft}$$
$$\text{New brake hp} = (116.5)\ (1.258)^3 = 231 \text{ Bhp}$$

The efficiency remains "unchanged" at 72 percent. Actually, there tends to be a slight increase in efficiency because certain losses don't increase as rapidly as pump output.

The preceding relationships are illustrated in Fig. 4.

Head-Capacity Curve Shape

The head-capacity curves for an assortment of centrifugal pumps would show a common "drooping" or falling characteristic. This means that with an increase of flow there is a definite decrease in head. Sometimes this is a very desirable feature; as where two or more pumps are to operate in parallel, so that slight changes in head will not cause wide swings in the distribution of the total flow between the two pumps. It is also desirable where there are wide variations in the controlled discharge pressure, to minimize the variations in flow.

Sometimes, as with a boiler feed pump operating alone, it is desirable that the delivered capacity vary widely with only a slight variation in pressure. In Fig. 5, there is no great difference in heads between points of operation *A*, and *B*, but there is in their capacities. This pump has what is referred to as a *flat* characteristic.

Viscous Fluid Alters Curves

It has been stated earlier that corrections will be required for viscosity to the curves for pump head, capacity, efficiency, and horsepower.

The nature of the corrections to the performance curves will be as illustrated by the broken-line curves in Fig. 6.

Frequently, in order that the pump driver (motor, turbine, or engine) not be overloaded in the event that the pump accidently or purposely is called on to deliver maximum capacity, the driver may be sized so as to be "non-overloading."

In this event, the driver horsepower, normal rating, must equal or exceed the maximum required pump brake horsepower as shown on the pump performance curve for the specific gravity and viscosity of the liquid to be handled.

In Fig. 6, we see that the driver would have to have a horsepower rating y to be non-overloading on water, but y' if used with the particular viscous fluid for which the curve is drawn. Similarly, in Fig. 1, the maximum horsepower for water would be y, but for gasoline, with a specific gravity of 0.75 it would be reduced to y', where y' equals $0.75y$. ‡

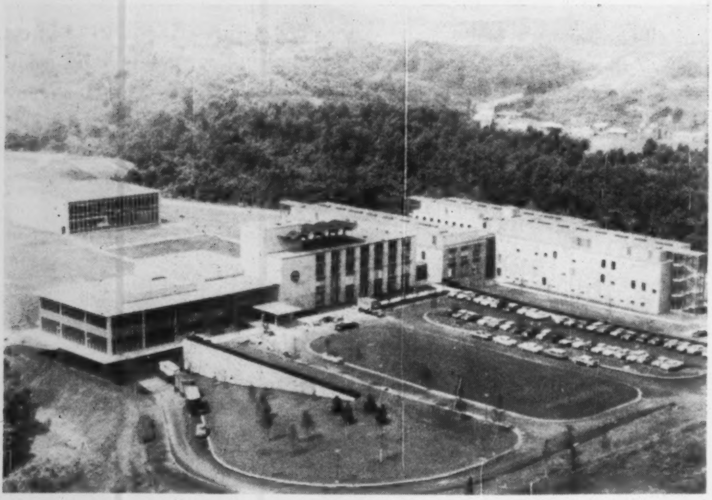
The concluding article in this series will deal with the subject of Net Positive Suction Head and what it means to the engineer selecting centrifugal pumps.

What kind of structure is hardest to air condition — a steel mill, a large office building, an industrial plant where resins and adhesives are used, or some other type of building? The answer is simple: It's a structure that encompasses all of the above operations. And obviously, the only business that would have its finger in so many pies is a modern physical — chemical research center.

Here's a report of how an air conditioning system handles such a herculean task.

Air Conditioning System in New Research Center Prevents Toxic Fume Accumulation

In a research program as diversified as that carried on at the new Koppers Research Center in Monroeville, Pa., almost every type of air problem encountered in any industrial or office building may be found. Koppers conducts research in both physical and chemical aspects of plastics, coal, tar products, metallurgy, heavy machinery manufacture, effluents control, steel mill construction and operations, building materials, resins and adhesives, and a wide variety of other miscellaneous research programs.



KOPPERS RESEARCH CENTER consists of a main building to which is attached three laboratory wings; a boiler house (seen in background to left); and various other structures

It is therefore no wonder that the center's designers had problems in devising an air conditioning system that would accommodate the structure and the many research programs.

Research itself creates certain problems. Constant temperature and humidity control over lengthy periods of time are necessary to protect the validity of some experimental work. The climate conditions in the Monroeville area do much to thwart such fine control of the inside environment. Annual outdoor temperatures range from extremes of −10 F or lower to temperatures near 100 F.

The type of construction used in this research center is another feature that caused the engineers additional problems in designing the air conditioning system. Large areas of glass are used, facing every geographical direction. And it must be kept in mind that the experiments themselves frequently create unusual heating and cooling loads.

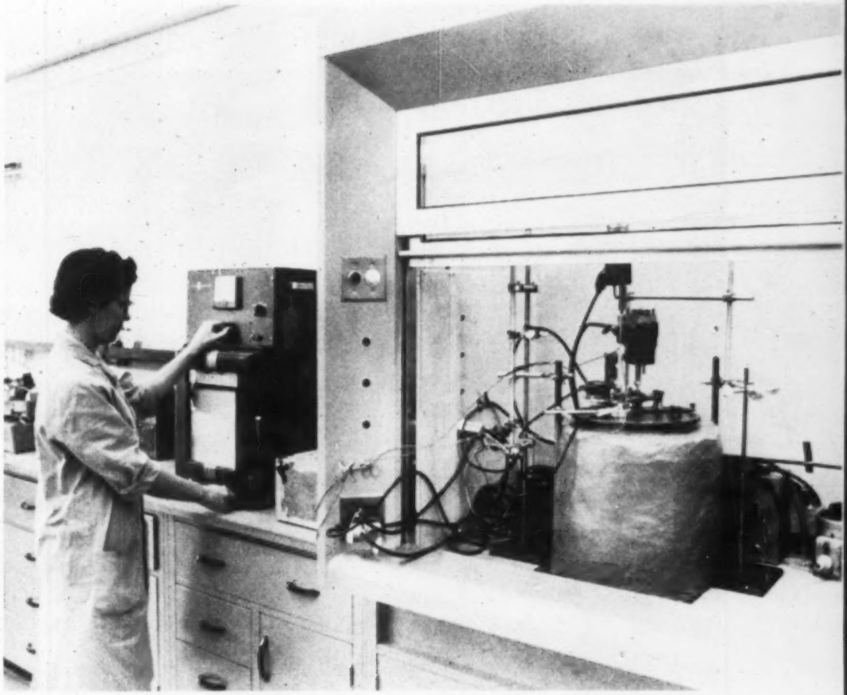
But even more important than temperature and humidity control is the control of air flow. Chemical research often involves processes that could lead to the emission of toxic fumes. To protect the safety of the scientists and lab technicians who are conducting the research, these fumes cannot be allowed to accumulate.

Size of Research Center

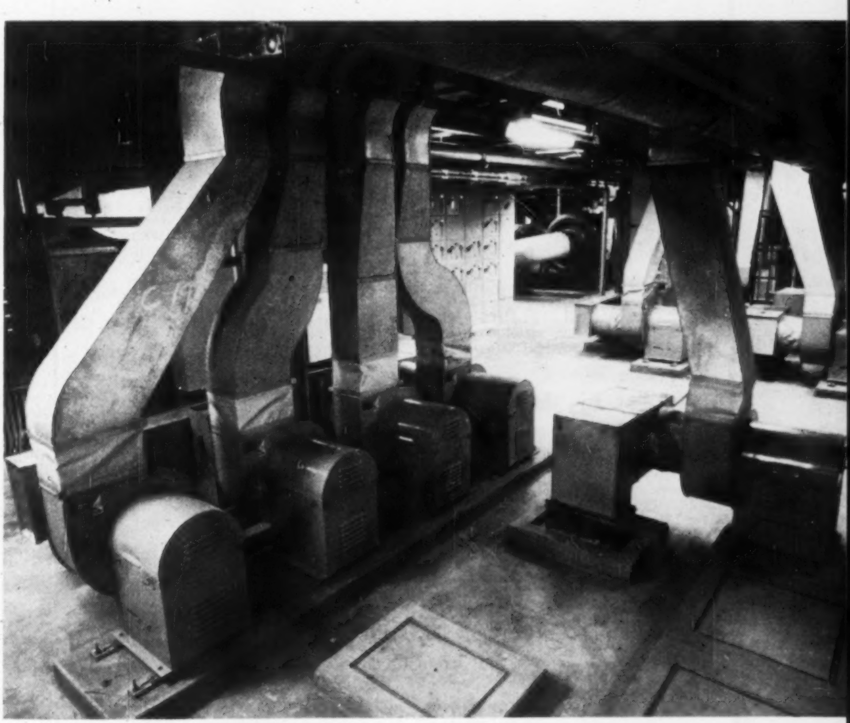
The first stage of construction, now completed, includes an administrative building which has executive offices, library, auditorium-conference room, cafeteria, and other supporting facilities. In addition there are three laboratory wings which contain both laboratory and office space for research personnel. Other buildings include a boiler house containing auxiliary and emergency power equipment, a switch-gear house, and a large cooling tower.

Air Flow Control

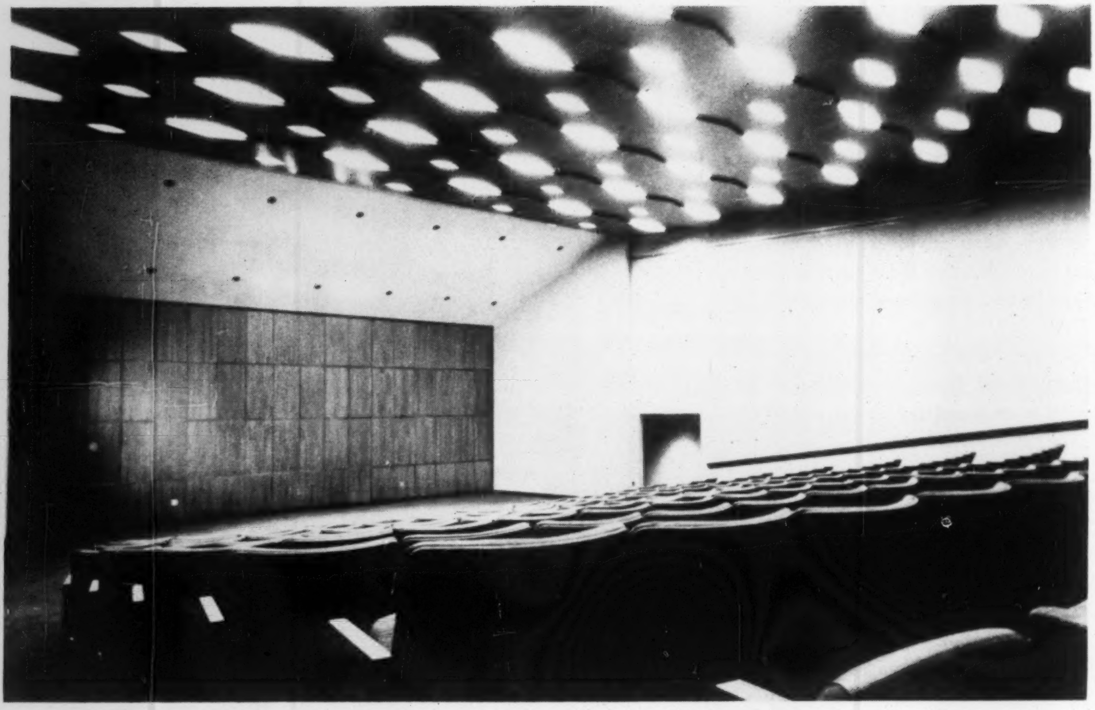
Positive and negative atmospheric pressures are used in the wings to remove the possibility of a build-up of toxic fumes. Specially designed fume hoods—some of them large enough to serve as "walk-in" areas—are used to help create these pressures. Each laboratory unit is under a negative atmospheric pressure so that air will flow into it from the corridors and offices on the other side of the corridors. Each office is under positive atmospheric pressure so that air constantly flows out, preventing air from the labs from flowing in. The fume hoods are themselves pressurized in such a manner that air flows into them from built-in supply outlets which cause a portion of the room air to be admitted with it. This air is



FLOW OF AIR in laboratories is always toward fume hoods which exhaust air constantly to assure safety of personnel. And since all laboratories are under a slight negative atmospheric pressure, any possible toxic fumes would be confined to the lab area. As a double safety check, offices across the hall from the labs are under a slight positive atmospheric pressure so laboratory air will not enter



EACH laboratory has its own exhaust fan. Note fan mounting pads for future expansion needs



AIR IS SUPPLIED to this ultra-modern auditorium through narrow line air diffusers, approximately 2 ft below ceiling

removed constantly through the exhaust system.

Air Distribution System

The air distribution system is a high velocity, single duct system. The air enters each room or lab through boxes which contain hot water coils and venturi constrictions, and passes through deflecting grilles located near the floor and mounted in the wall paneling. Only the library is conditioned by a hot and cold deck system.

Two types of air handling units are used: a high pressure induction series of units on the building perimeter, and low pressure diffuser units in specific interior locations such as in the fan lofts which are on top of each laboratory wing.

Incoming air is filtered by a blanket type, prefolded, renewable media filtering system which is in a vee-bank configuration.

Temperature Control

For temperature control, which must be maintained within ± 2 F, the supply fan start switch is operated, opening the outside air damper and completing an electrical circuit through the damper end switch which starts the supply fan. The preheat coil steam valve is thermostat-controlled to maintain the proper setting. Another thermostat controls the reheat coil valve and cooling coil valve in sequence to maintain its setting. Thermostats under each window modulate heating coil valves to maintain desired room temperatures. Desired water temperature is maintained by thermostat-modulated valves. Outdoor thermostats reschedule indoor thermostats which modulate the valves maintaining proper water temperatures. Freeze-protecting thermostats stop supply fans when the outdoor temperature falls below their settings.

Humidity Control

For humidification, a humidistat activates a relay operating the valve which controls the steam humidifier. For dehumidification, a humidistat-controlled cooling coil causes incoming air moisture to condense.

Triple-glazed windows are used in certain labs in order to minimize heat loss and gain, thereby aiding in the control of temperature and humidity.

Voorhees, Walker, Smith, Smith & Haines designed the air conditioning system. The Limbach Co. was the mechanical contractor. ⌗

Joint Industry Committee Presents The New Chicago Plan for Separate Bids

By HENRY J. COUCH
Executive Secretary
Coordinating Committee
Mechanical Specialty Contractors
Associations of Chicago

In 1960 a new bidding plan, called "The Chicago Plan for Separate Mechanical Specialty Contracting Bids" was formulated by the Coordinating Committee of the Mechanical Specialty Contractors Associations of Chicago (see text for member associations).

The brochure outlining the "Chicago Plan" was widely discussed in the industry[1]. It described in detail circumstances which led to bid-shopping and peddling, and the serious consequences that had to be expected from a continuation of such practices.

In response to the interest expressd in the new bidding plan, a Joint Industry Committee of architects, engineers, and builders set out to broaden and perfect this idea as an initial step in eliminating unhealthy bidding practices.

The result is "The new Chicago Plan for Separate Bids" described in this article. In essence, this is a plan based on the idea of a single contract but separate bids (and separate specifications) for general construction and each of four specialties, including heating, piping and air conditioning and ventilation.

Mr. Couch notes that there will be an open meeting in Chicago this month (Nov. 13) to discuss the plan and means to implementation. Not every engineer will be able to attend, but we recommend that all engineers and contractors whose interests are affected by bidding and other business practices in the heating, piping and air conditioning field obtain a copy of the new brochure which discusses the plan in detail.

They are available from the author at Room 1612, 228 North LaSalle St., Chicago 1.

THE BUILDING construction industry, as represented by the architectural and engineering professions, by general construction contractors and by mechanical specialty contractors, can be justly proud of the accomplishments it has achieved. No one coming to Chicago, for instance, can fail to thrill to the distinctive character of our schools and churches, the incomparable sky line, our shops and offices, factories and public buildings.

That these things came to be is not without cause, nor without reason. They exist because of the cooperative efforts of many men, either as designers or as builders. They were men of vision, of integrity and of courage. They shared the dream of a great city and by faith and trust in one another they made this dream come true.

Gone Are the "Good Old Days"

Now we are in a new era, with new challenges and new problems. We must meet these challenges and resolve these problems in terms of today's realities. We cannot survive in today's society by wishing it were still yesterday, nor by applying the standards and definitions of a past era.

The leisurely pace of other times has long since been denied us. We must live at a pace we did not choose and which we cannot command. The price we pay cannot be weighed; but pay it we must, and in many different ways.

Even our sense of values is being distorted, not individually perhaps, but certainly collectively.

Redefining Accepted Ideas

Take for example the concept of "integrity." Everyone believes in it. Everyone tries to apply it vigorously to each phase of his private life. Yet we hear on every side and at every level, "Integrity no longer exists." A man's word, it is said, is no longer to be taken at face value.

Whether this be true or not is of little moment. If it is a belief commonly held — and it is — the effect is the same whether it be true or false.

"Competition" is another term that has taken on new shades of meaning and new areas of application. It is frequently used to condone actions which would lead to ostracism on the golf course, or which in normal social contacts would be met with disdain.

---

[1] *Mechanical Specialty Contractors Devise New Bidding Plan*, Heating, Piping & Air Conditioning, Vol. 32 No. 11, November 1960

Many other examples could be used to illustrate the slow erosion which is undermining the modern world of business and to which the building construction industry has not been immune.

To compensate for these changes — and in order to survive them — it becomes necessary at times to reconsider our judgments; to reappraise our methods. It must be determined whether or not we are perpetuating systems and procedures that are an invitation to men without scruples, and it must be asked whether we are not penalizing the very virtues of integrity and honesty and ethics which we would so like to re-establish.

Concerted Action Begins

On May 18, 1961, a Joint Industry Committee met for the first time to consider, soberly and realistically, these questions as they apply to bidding procedures in the building construction industry.[1] Represented at this historic meeting were the Chicago Chapter of the American Institute of Architects, the Chicago Association of Consulting Engineers, the Builders Association of Chicago, and the Coordinating Committee of Mechanical Specialty Contractors Associations of Chicago.

It was the feeling of the Joint Committee that certain realities must be accepted, no matter how unpalatable. No longer can it be denied that when a general contractor refrains from bid-shopping, in accordance with AGC's code of ethics, or when a mechanical specialty contractor, similarly inspired, does not engage in bid-peddling, he places himself in what is virtually an impossible situation. He simply ceases to be "competitive."

To condemn such practices is not enough. To believe that they can be eliminated thereby is wishful thinking. They are evils of the times and so long as single bid procedures prevail they must be embraced as a drowning man would clutch an overhanging branch of poison oak — or perish.

New Plan

The Joint Industry Committee unanimously agreed that there was no choice other than to recommend a new and completely different system of bidding, and on August 11, 1961, they adopted "The New Chicago Plan for Separate Bids."

The committee in no way suggests that the responsibilities and prerogatives of any group be lessened or abrogated. The respective functions of the architect and engineer to design and of contractors to build are neither questioned nor in need of change. They are distinct, exclusive, and should remain so.

Traditional Relationships Remain

Neither does the Joint Industry Committee suggest that the traditional relationship of the respective groups to each other should be modified. There is no compelling evidence to support any such suggestion. The architect and engineer represent and speak for the owner, as his direct agents. The general contractor is and should be responsible for all phases of construction, including supervision and coordination. He should be adequately compensated for these services and he should be given complete control of all mechanical specialty contractors through assignments of their contracts.

The mechanical specialty contractors, in turn, should cooperate fully with each other and with the general contractor in the execution of their particular specialties. Their right to prompt payment in accordance with the terms of their contracts should be protected so that they can meet their obligations to their employees and suppliers.

It is the conviction of the Joint Industry Committee that the practices of bid-shopping and bid-peddling which threaten to demoralize the building construction industry on a national scale must be stopped.

It is the further conviction of the committee that a solution can be achieved at the local level through separate bids and through the mutual efforts of the groups most directly concerned.

"The new Chicago Plan for Separate Bids" has been formulated. It now must be implemented.

Will Meet to Discuss Plan

Initial action toward such implementation will take place at Chicago's new McCormick Place on the evening of November 13, 1961. At a dinner meeting sponsored by the Chicago Chapter of the Construction Specifications Institute, a panel consisting of

E. H. Matthei, Architect
John Dolio, Consulting Engineer
E. H. Marhoefer, Jr., General Contractor
W. A. Kuechenberg, Mechanical Specialty Contractor, and
J. C. Sanderson, Northwestern University

will discuss the new Chicago Plan in detail, followed by an extensive question and answer period. The meeting chairman will be R. G. Burkhardt, Consulting Engineer, and the panel moderator will be Henry J. Couch, Executive Secretary of the Coordinating Committee. Both Burkhardt and Couch are active members of CSJ.

This will be an open meeting, to which any one interested in or associated with the building construction industry has been invited. ‡

---

[1] *For photo and list of those present, see "You'll Want to Know," page* 50.

Industrial Ventilation Can Be More Effective and Cost Less

The advent of larger industrial plants, many of flat-roof design, and the development of numerous high speed, heat producing processes are circumstances which call for a second look at some of our industrial ventilation practices.

Data obtained in various parts of the country indicate that it is in fact possible to provide comfortable working conditions in modern plants for reasonable cost — if the problem is approached properly.

Here are some design approach suggestions based on heating, cooling, air distribution, and exhaust methods that have already been proved effective in a number of plants.

To PROVIDE an in-plant environment that will reduce complaints of discomfort, improve production, and be obtained at economical installation and operation costs, the designer should consider first of all the question of how man is affected by his surroundings.

Man is a warm-blooded animal. The engineer's responsibility is to control his rate of heat loss — never to heat him. Heat is lost from the body mostly by convection and evaporation, and the extent of heat loss will vary according to the temperature, motion, and moisture content of the surrounding air.

Design Should Be Realistic

The practical and logical approach to industrial heating and cooling is one which takes into account those factors which are related to the control of human heat loss. Besides this, any design plan ought to assume that the system will be used 12 months out of the year, irrespective of outside weather.

Accordingly, the system will be required to clean, heat or cool, and move the air into the area occupied by the employee. The basic components to do this would be filters, heating or cooling source, fans, and ducts. Except for the ducts, all of this equipment may well be centralized in a penthouse. This will allow simple installations, maintenance, and the effective integration of all component parts.

Is the Job Being Done?

In a great many cases, existing methods of controlling in-plant environment need to be improved. Many present-day industrial heating systems leave cold areas near outside walls and doors while the temperature is excessive near the building center. Exhaust systems are frequently inefficient; objectionable haze develops in the plant center. Finally, many systems simply cost too much to run.

Traditionally, summer temperature control is not attempted through the same system used for winter heating. Attempts to reduce summer temperature levels generally are limited to experiments with exhaust systems. These are no longer suitable, because of the fact that new plants are constructed with flat roofs (and in larger sizes), high speed operations produce increased heat effects, and better environments are being demanded both for reasons of production and for better employee morale.

Frequently used methods of treating air for industrial plants, which usually employ a number of separate units located among the building trusses, are not designed in accordance with the physiological requirements of man. They do not provide for even distribution of air, and often produce hot spots near the floor. Again, such systems tend to project hot contaminated air from the roof area where it accumulates, back down upon the employees. This kind of system cannot be used effectively for summer cooling.

There Is a Better Way

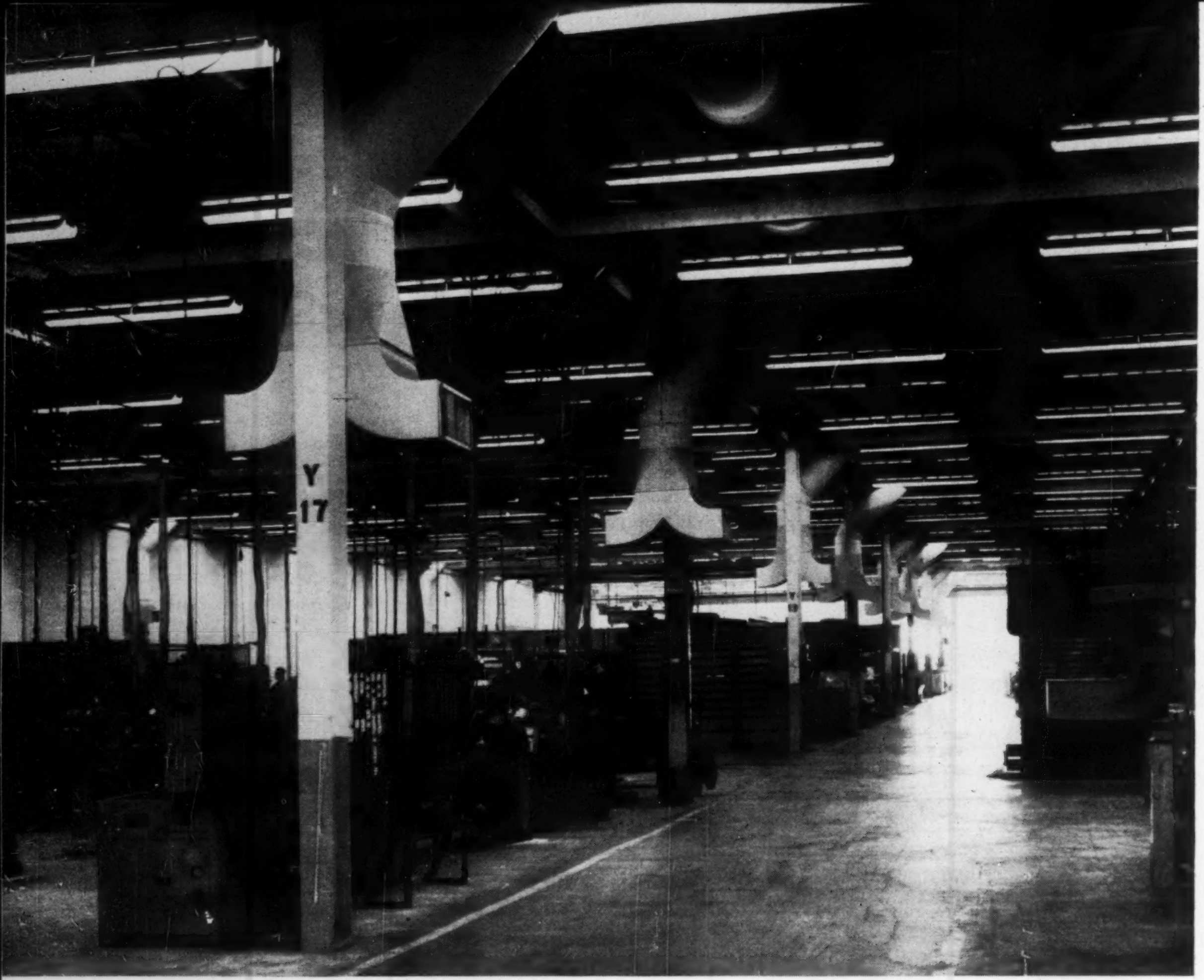
A more efficient system, in which the principal equipment is housed in a central penthouse, uses overhead ducts to distribute air throughout the plant. A unique and very important characteristic of this design is that the ducts are "dropped" from the upper regions to a point 10 ft above the floor (Fig. 1).

This technique allows filtered outside air to be delivered directly to the space occupied by the employees. Adjustable grilles on the duct terminals allow the air to be directed over employees' heads in winter, or upon them in summer.

During cold weather, a well-engineered control system can automatically regulate the heat input to provide the conditions required in the plant, regardless of outside temperature, the quantity of outside air handled, or heat generated by plant operations.

What Are the Advantages?

During the winter months, this kind of system may well reduce the cost of heating (as compared with the



1 INDUSTRIAL VENTILATION SYSTEM described as improvement over many existing installations has all air treatment equipment housed in central roof location, delivers air through outlets 10 ft above floor. This is more efficient, adaptable to cooling addition

"truss mounted" system) because outside air can be tempered and distributed effectively. Objectionable cold drafts around the building perimeter walls and near doors can be eliminated or greatly reduced. Haze and low level non-toxic contamination can be controlled by proper air dilution.

In summer, the man's rate of cooling is increased by the high air motion of outside air directed over him. Since air is widely and evenly distributed, the plant interior will cool down rapidly when the outside temperature decreases. Gravity roof ventilators, which are often recommended for heat and smoke release in case of fire, can be used effectively to vent unwanted summer heat. Finally, the better distribution pattern below the 10 ft level serves to effectively increase the ventilation or dilution rate in the occupied space with no increase in air volume.

Cooling Is Easily Added

Should further hot weather environment improvement be desired, it can be accomplished by adding standard components to the basic system. The first addition might be an evaporative cooler. As shown in Fig. 2, this could consist (and often does) of two rows of spray nozzles; one directed with the air flow and the other against; followed by an eliminator section to remove the droplets of water from the air stream. Water is recirculated through the system.

Later, if still more cooling is desired, chilled water can be piped to the evaporative cooler nozzles to reduce both the wet and dry bulb temperatures of the supply air.

What Are "Good" Conditions?

When men work in an environment exceeding 80 F *effective* temperature, their rate of work decreases and the incident of accident and illness rises. Therefore, in the charts which follow, an 80 F effective temperature line is included as a suggested maximum condition for continuous exposure. Also on these charts, ideal winter and summer effective temperatures of 68 F and 71 F, respectively, are shown. It is not suggested that these ideal conditions should always be provided in an operating plant, but they do serve as good comparisons for more easily attained conditions.

Graphs Show Possible Effects

To assist in the evaluation of any basic industrial ventilation system, consider the official weather bureau data presented in Fig. 3 for Baltimore. In Fig. 3, temperature is plotted on the vertical axis, and time of day on the horizontal. Curve *A* is plotted from the maximum DB temperature recordings which occurred during August 1959 at the hours indicated. Curve *B* is a plot of the corresponding WB temperatures. Curve *C* represents the effective temperature that would be sensed by an individual when exposed to these conditions in still air. Note its relationship to the suggested maximum effective temperature of 80 F.

Curve *D* depicts the benefits realized when air is moved over a man at a velocity of 200 fpm, with all temperature conditions as stated above. It will be seen that the maximum suggested effective temperature is still exceeded, but both the differential and the total hours are substantially reduced.

If the air is passed through an 80 percent efficient evaporative cooler before being projected over the employee at 200 fpm, the effective temperature would, in all cases be below the suggested maximum. This is shown by Curve *E*. In spite of the high WB temperatures associated with Baltimore, it is clearly illustrated that the in-plant environment can be maintained below the suggested upper limit of 80 F effective temperature, which should allow for full production without undue stress on individuals. This assumes, of course, that the combination of air velocity, duct length, insulation, etc., between cooler and duct outlet is such that heat transfer between the air in the ducts and the warmer under-roof air in the plant is reasonably slight.

The same type of information has been plotted in Fig. 4 — this time for Atlanta, Ga., where the DB temperatures are high but the WB temperatures lower than in Baltimore. The effective temperature with still air (Curve *C*) is about the same as Baltimore.

Because of the lower WB temperature in Atlanta, the relative humidity is also lower. Therefore, with an air velocity of 200 fpm, moisture will evaporate from the skin at a higher rate, resulting in a lower effective temperature. This is shown by curve *D*, which closely follows the 80 F effective temperature line.

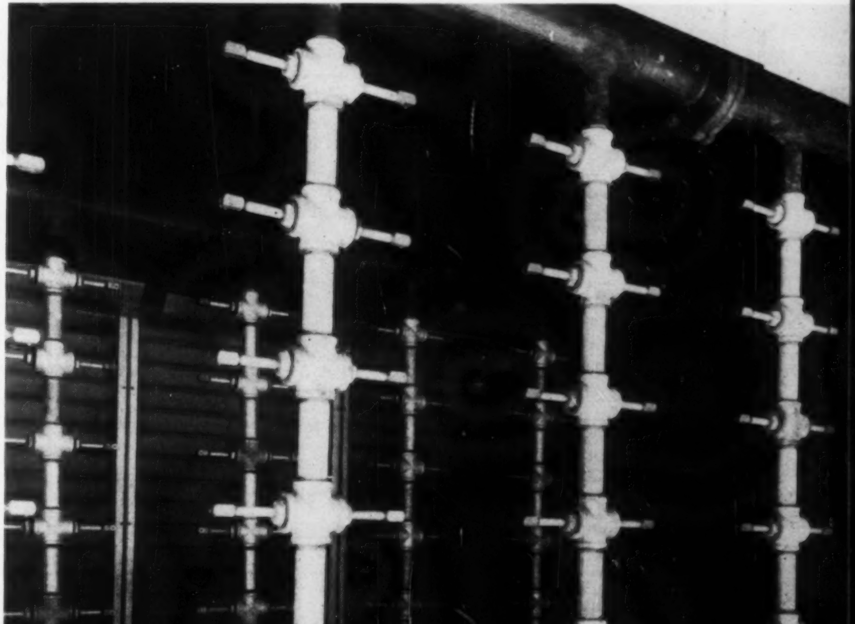
Effect Depends on DB/WB Difference

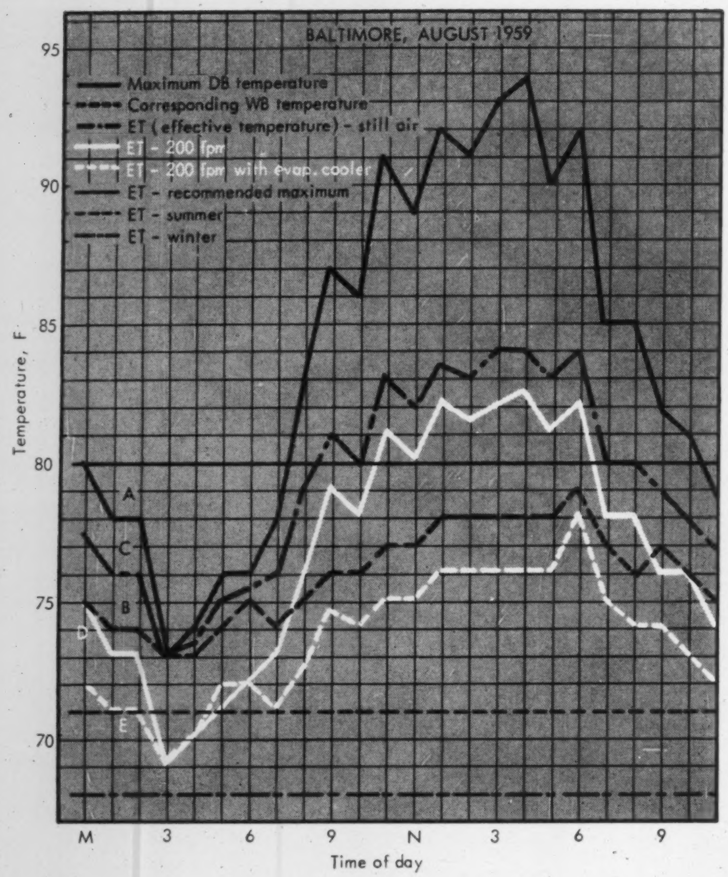
The benefits that can be obtained from an evaporative cooler are determined by the depression of the WB below the DB temperature. Since this difference is greater in Atlanta than in Baltimore, air from the evaporative cooler should result in a lower effective temperature. Curve *E* demonstrates the improvement that could be expected by the proper use of such equipment in Atlanta.

These data show that a basic installation such as has been described will improve the in-plant environment by supplying air at a significant velocity. The addition of a simple evaporative cooler will result in a lower effective temperature — better worker conditions.

This phenomenon is due directly to the high air motion and to the fact that air is distributed where it will do most good. As the DB temperature of the air is below skin temperature, the body will be cooled

2 FURTHER GAIN in plant environment control, in form of hot weather cooling, can be accomplished by adding, to basic system, of opposed water spray nozzles in supply air stream, which can be supplied with untreated or chilled water. Eliminator panel in background removes excess water from air





3 WEATHER BUREAU data for Baltimore shows maximum DB temperatures occurring during August 1959 (Curve *A*); corresponding WB temperatures (*B*); and effective temperature (*C*) that would be sensed by individuals under these conditions in still air. Note benefits realized when air is moved over man at 200 fpm (*D*), still more when air at same velocity is passed through 80 percent efficient evaporative cooler, *E*. See further explanation with Fig. 4

by convection rather than by evaporation. Therefore, relative humidity will not be an important factor.

A still lower summer effective temperature can be obtained by additions to this basic system. For instance, chilled water can be used in the evaporative cooler during hours of unusually hot or humid weather.

Table 1 is a cost analysis of this kind of system *vs* a "conventional" air conditioning installation for industrial plants. The latter is basically the same as that used in theaters, office buildings, etc., wherein air is chilled to about 55 F for distribution to outlets. Extensive ducts and properly designed diffusers are absolutely necessary to the conventional air system if

TABLE 1 — TWO COOLING SYSTEMS for the same 1 million sq ft industrial plant, one a "conventional" type using air cooled to about 55 F and distributed through high-up, individual units, the other using chilled water in an evaporative cooler to condition air for distribution at the 10 ft level, would result in ***refrigeration*** costs as itemized below. Installed and operating costs for the necessary compressors are based on common-sized units, include associated pumps and piping for chilled and condenser water services. Substantial savings with the proposed system result from a basic difference in design approach — wherein no attempt is made to cool all plant air, but instead, proper environment is provided at worker level, unwanted plant heat exhausted to the atmosphere

	Conventional system	Proposed System
Cooling air required, cfm	6,280,000	2,000,000
Refrigeration needed, tons	12,660	3600
Refrigeration installed cost at $200 per ton	$2,532,000	$720,000
Refrigeration operating cost per hr at 1c per hr per ton	$126.60	$36
Estimated hrs of compressor operation in Baltimore for two shifts during August 1959	525	200
Estimated compressor operating cost, August 1959	$66,465	$7200

objectionable drafts are to be avoided. Because all unvented heat must be absorbed by the circulated air, large air volumes are necessary.

The comparison in Table 1 is based on an assumed plant floor area of 1 million sq ft, with a plant heat load of 125 Btu per hr per sq ft. Design conditions (outside) are 95 F DB and 75 F WB. An effective temperature of 73 F is to be maintained in the work area.

Chilled water is used in both systems — in coils with the conventional plan, and in the evaporative cooler in the alternate. It is assumed that compressors would operate during two plant shifts, whenever the outdoor temperature exceeds 80 F with the proposed design and 65 F with the conventional system.

Calculations are based on controlling only the heat generated within the plant plus that removed from the outside air. To simplify the calculations, latent heat was also ignored.

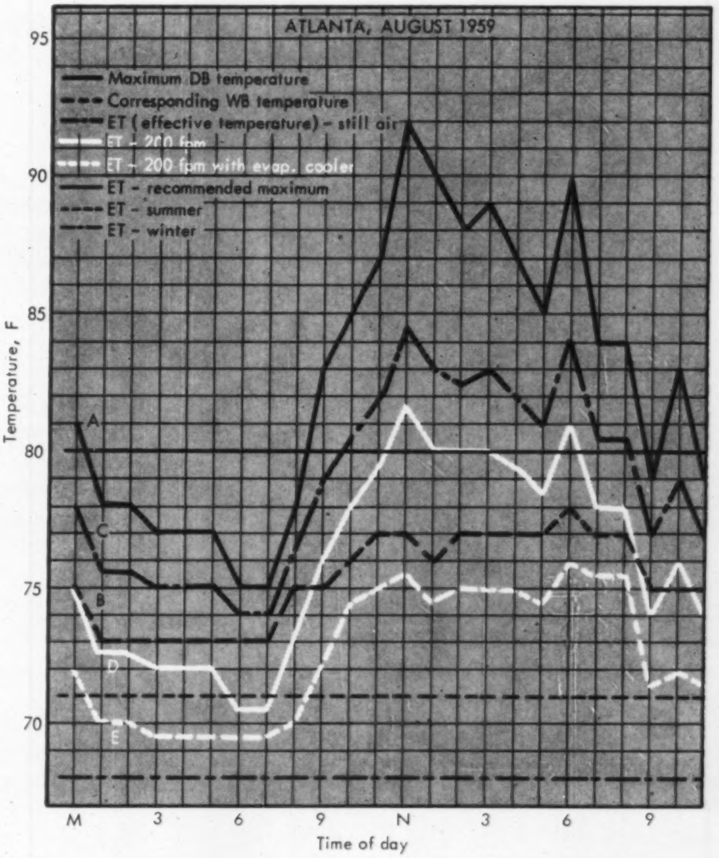
In the alternate, or proposed, system, 100 percent outside air is used. With this kind of system, no attempt need be made to absorb heat from plant air. Rather, a suitable environment is created by delivering air to the workers. Heat is then carried out of the building by the conditioned air as it is vented through the roof. The temperature rise of the air as it rises to the ceiling and is expelled can be calculated for any particular installation.

The comparison in Table 1 is based on the relative costs of the mechanical refrigeration only — that is, for the compressors which will be required, plus the associated pumps and piping for chilled and condenser water services. The installed and operating cost values are reasonable for systems serving large plants. Extremely large or much smaller installations could vary somewhat due to radical changes in equipment sizes.

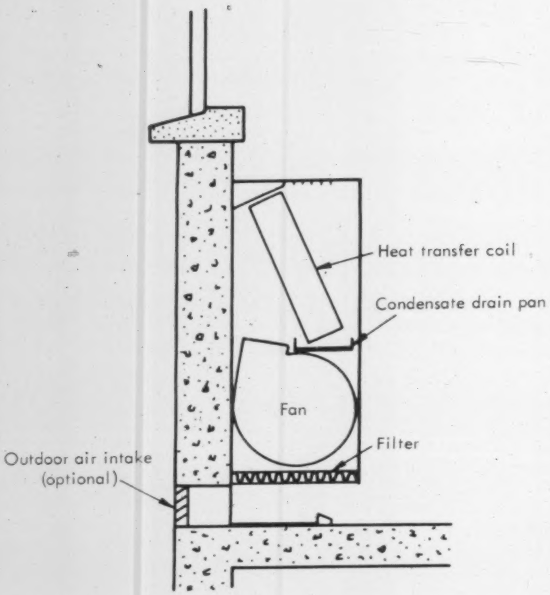
The proposed system, using artificial cooling for the evaporative installation would, as shown in the Table, result in an installation saving of $1.8 million plus an operational saving of as much as $60 thousand per month. Additional coils and air handling equipment required by the conventional system would increase that differential.

System Is In Use Now

The soundness of the basic system discussed here has been proven in a number of plants. Some have already installed evaporative coolers to further improve the summer environment, and a few are using the basic system with mechanical refrigeration — these have shown a considerable reduction in required capacity. ǂ



4 SAME DEFINITIONS apply to these curves as noted in Fig. 3. Also plotted are maximum suggested summer, winter, and "working" effective temperatures. Note that with proposed system, effective temperature is in all cases below suggested maximum of 80 F when chilled water evaporative cooler is used, and that even with untreated water time and amount when and by which maximum is exceeded are substantially reduced. Text explains why benefits are even greater in Atlanta (*right*) than in Baltimore (Fig. 3)



1 STANDARD FAN-COIL UNIT will include fan, water-to-air heat exchanger, filter, drain pan, and some provision for fan speed control. Outdoor air intake may be provided, is normally limited to 25 percent of total air supply through unit

Here Are Your Choices For Fan-Coil Unit Control

By JOHN N. PRATT
Manager, Product Research
and Field Service
Warren Webster & Co., Inc.

A great number of ways to control fan-coil unit air conditioning systems have been devised, with more or less success. Depending upon what the design engineer intends, and what the owner is willing to pay for, such units can be completely control-separated or combined in simple or intricate networks. The result will be, as always, varying degrees of satisfaction.

Choosing a control system requires first of all an understanding of what can be done — then the best way to go about it. Here the author describes the major fan-coil unit control arrangements available, and tells what to expect in the way of advantages and shortcomings from each.

THE fan-coil unit year 'round air conditioning system can represent one of the more economical installations presently available. First cost is comparatively low, little useable building space is needed, and the system affords simplified individual space control. As in all comfort engineering, however, the proper application of controls on fan-coil systems is of utmost importance.

The ways used to control individual fan-coil units are almost infinite in number. As opposed to some other systems, where control methods are few and standardized, methods for controlling fan-coil units are numerous and unstandardized. It is, therefore, not surprising that many incorrect applications result.

Standard Unit Has Some Options

The standard fan-coil unit (Fig. 1) contains a fan, water-to-air heat exchanger, filter, condensate drain pan, and a fan speed control unit. For ventilating, a dampered opening may be provided in the base of the unit to admit outside air directly through the wall. Outside air intake is normally limited to 25 percent of the total supply quantity. Other models are available with or without cabinets for horizontal installation above furred ceilings.

Manual Control

The simplest method of control is by manual operation of the speed control switch which is standard equipment with the unit (Fig. 2). This least-expensive control involves no valves and no thermostats, and can be adequate if no temperature control is required on the cooling cycle, and if adequate heating control can be maintained by a central modulation of the hot water temperature.

A weakness appears, however, during the cooling season in humid climates. The room occupant can turn off the fan while chilled water continues to circulate through the coil. Excessive condensation on the unit will result, hastening corrosion of internal metal parts, shortening electric motor life, and causing unsightly and damaging condensation to appear on the unit cabinet.

If hot water temperature is modulated, this control method is applicable to ventilating applications. The fan can be left on most of the time in winter to bring outdoor air through the unit to be tempered and mixed with room air.

Next Step: Valve Control

This control method can be refined by the addition of a manual valve with handle accessible to the room occupant. This encourages the occupant to control room temperature with the valve instead of with the fan speed switch, reducing the possibility of interior and cabinet condensation.

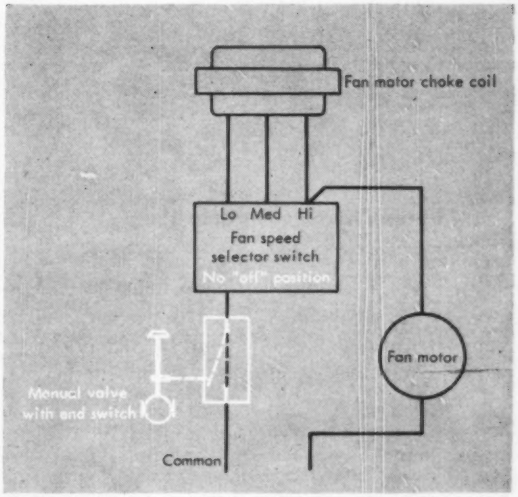
A further refinement can eliminate condensation entirely. Here, as shown by the overlay (white) lines in Fig. 2, the "off" position on the fan switch is eliminated, and the manual valve is provided with an end switch wired in series with the fan speed control unit. With this system, the only way to shut off the fan is to close the valve.

This should give a highly satisfactory, low cost method of control. Winter temperature control can be approximated by modulating hot water temperature. Only floor or low wall mounted units can be so equipped, obviously, since the control valve handle must be reachable from the room.

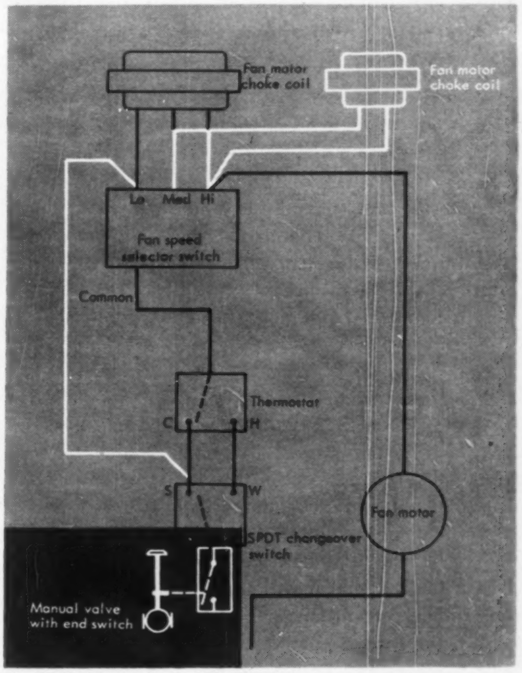
Fan Control

Fig. 3 shows a layout having on-off control of the fan by thermostat. Such a method provides year 'round automatic temperature control. In winter, if modulated water temperature is used, the flow of heat can be almost constant, the thermostat acting only as a limit control.

It is possible with this arrangement for the occupant



2 SIMPLEST CONTROL METHOD is illustrated by basic schematic shown here, consists merely of fan speed control switch supplied with unit, and may allow heavy condensation since water supply is not shut off with fan. Addition of accessible water supply valve is refinement to alleviate condensation problem. Further refinement (white) has valve wired with fan switch so that fan can be stopped only when water supply is secured •



3 THERMOSTAT CONTROL is next improvement. With modulated water temperature winter heat flow can be almost constant. Fan can be shut off either by switch or by thermostat, so same summer condensation problem is present. Alternate wiring method (white) prevents occupant from securing fan in summer, keeps fan cycling from low to medium to high. Still better arrangement (dark gray) provides valve with end switch, for continuous staged summer, on-off winter fan operation to shut off the fan either by the speed control switch or, in summer, by setting the thermostat to the extreme high position. Condensation may again be a problem in humid summer environments, and the change in noise level occasioned by the on-off fan action may in some cases be objectionable.

Avoid Return Air Thermostat

The thermostat must be wall mounted, since a return air stream thermostat will not have air circulated over it at all times. The fans may in fact be completely inoperative on the cooling cycle due to gravity circulation of cold air dropping from the coil onto the thermostat bulb. The thermostat will "think" the room is cool when actually only the air surrounding the bulb is cool. Therefore a return air stream thermostat may be successfully used in this application only if the unit is not used for ventilation, and if the air flow is constant.

The preferable method is to use a wall mounted low voltage thermostat which, because of its normally closer differential, will cycle the fan more frequently, resulting in smaller variations in temperature and humidity.

Fan Can Run Continuously

Another approach is illustrated by the overlay lines of Fig. 3. Wired as shown, the unit fan is always "on," cycling from high or medium to low; thus eliminating or reducing the possibility of objectionable condensation. The room occupant cannot turn off the unit during the cooling season. (This may encourage occupants to open windows, however.) In winter, the fan will cycle on and off under control of the thermostat.

Or — Stage the Fan

Still another refinement is indicated by the dark-shaded portion in Fig. 3. Here the fan operates continuously, but staged, in summer, and on-off in winter. The off position on the speed control switch is eliminated and a manual valve with end switch is the only means of turning off the fan in summer.

Such a system constitutes a satisfactory medium-priced control for fan-coil units Again, this method is not applicable to horizontal units since the manual control valve must be accessible.

Summer-Winter Changeover

Thermostats for controlling seasonal changeover must be of the single pole, double throw variety — one throw for cooling, one for heating. The systems shown in Fig. 3 include, in addition to the thermostat, SPDT switches for changing from heating to cooling or reverse. Such switching action can be accomplished in several ways with electric controls:

1) Automatically at the unit by means of a temperature sensing switch strapped to the pipe.

2) Manually at the unit or on a wall "heat-cool" switch. This method is mentioned only because it is frequently used. We will show later that this is not good practice.

3) Key operated at the unit or on the wall.

4) Manually from the boiler room by connecting corresponding wires from each unit together and running to an SPDT switch in the boiler room.

5) Automatically from the boiler room as in (4) but with a temperature sensing switch strapped to the hot-chilled water pipe.

Action Will Differ Accordingly

Each of the above methods has certain characteristics. Automatic temperature sensing switches often used may have differentials which are quite high — effectively as high as 40 to 50 F due both to the characteristics of the device and to its normally poor contact with the pipe. This has no ill effect unless modulated water temperature is used in winter. In this case, during changeover from cooling to heating, it is often necessary for the operating engineer to circulate unmodulated boiler water for a time to actuate all changeover switches. This can also be true with a single automatic device in the boiler room, except that economics will allow the use of a temperature sensing switch having a closer differential. On large jobs, however, it is not economical to run the wires to the central equipment room.

Second Way Leaves "Carryover"

The use of the manual "heat-cool" switch (alternative 2, above) is a common mistake in application. With the system on the heating cycle, the occupant may throw the "heat-cool" switch to cool and turn the thermostat down. The fan will go on, and since there is hot water in the coil, the room will get warmer instead of cooler. The thermostat will never be satisfied and neither will the occupant.

With key-operated switches, it is necessary for maintenance personnel to enter each room and manually operate the changeover switch. This changeover must be properly timed. In the equipment room changeover is effected by opening and closing appropriate valves so that system water flows through the chiller instead of through the boiler, for instance. A compressor should not be started, normally, until the water cools down to about 70 F. If untempered boiler water is used for heating, it may take the insulated piping system as long as 24 hrs to cool off sufficiently to allow the chiller to operate. To prevent overheating of rooms, the manual changeover switch at the units must not be changed to cooling until the chillers are in operation.

It is good practice, where modulated hot water temperature control is not used, to put a water temperature sensing switch in the chiller control circuit to prevent chiller operation until system water temperature is down to 80 F or lower. It is also wise to provide for chilled water circulating pump operation during this cooling off period to speed the cooling process. Modulating the hot water temperature will of course eliminate such problems.

Generally, the most effective electrical changeover system utilizes a relatively close-differential, pipe-mounted temperature sensing changeover switch at each unit as described in alternative 1, above, with modulated hot water temperature in winter. On large buildings, the changeover function should be zoned by exposure for best results.

With pneumatic control systems, changeover is accomplished at the equipment room, simply by changing the control air pressure.

Valve and Fan Control

Further refinement of individual fan-coil unit control involves the use of an automatic water valve, cycled by the thermostat, plus the fan speed control unit. The valve may be electric (solenoid or motorized) or pneumatic; two-way or three-way; modulating or two position.

With such a valve, the fan may operate as follows:

1) Continuously.

2) Intermittently with the valve.

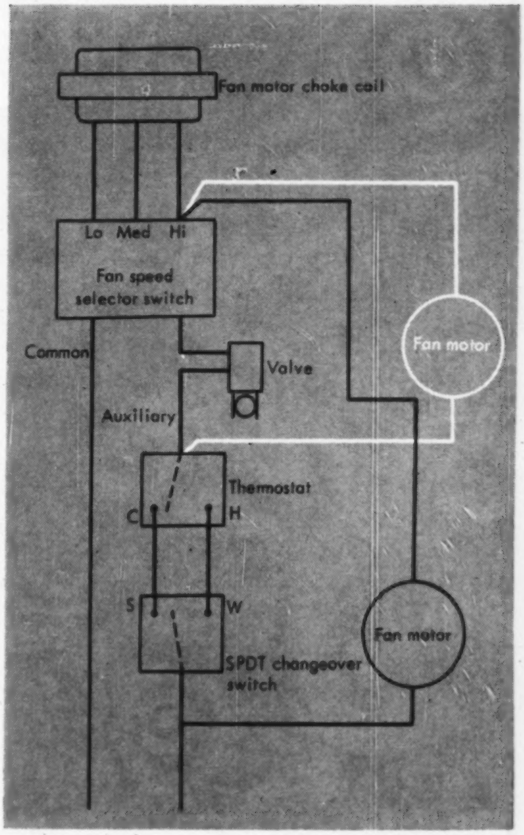
3) Continuously during cooling; intermittently during heating on a coil mounted fan switch.

Continuous fan operation is particularly desirable when the unit is equipped to bring in outdoor air. This provides continuous, tempered ventilation by outdoor and recirculated air mixing. Otherwise, outdoor air can discharge into the room through the recirculated air inlet during fan "off" periods, resulting in cold floors and drafts near the unit.

Outdoor air intake is usually limited to 25 perecnt of the total, so the discharge air temperature will not normally be below 60 F. In certain environments when this discharge temperature is too low (for instance, in a home for the aged) best results will be obtained by modulating hot water temperature and/or using modulating valves. Either or both of these modifications should result in a discharge temperature above the discomfort point.

Use of Return Air Thermostat

A return air stream thermostat can be successfully used in a non-ventilating application with continuous fan operation. This is not recommended, however, when outdoor air is introduced through the unit, for reasons noted above. A wiring diagram for a two-position valve, continuous fan arrangement is shown in Fig. 4. Note that the valve is interlocked with the fan speed control switch to provide positive valve shut-off when the fans are manually turned off. This is a desirable feature for all valve controlled arrangements. It positively prevents the harmful interior and cabinet condensation mentioned earlier.

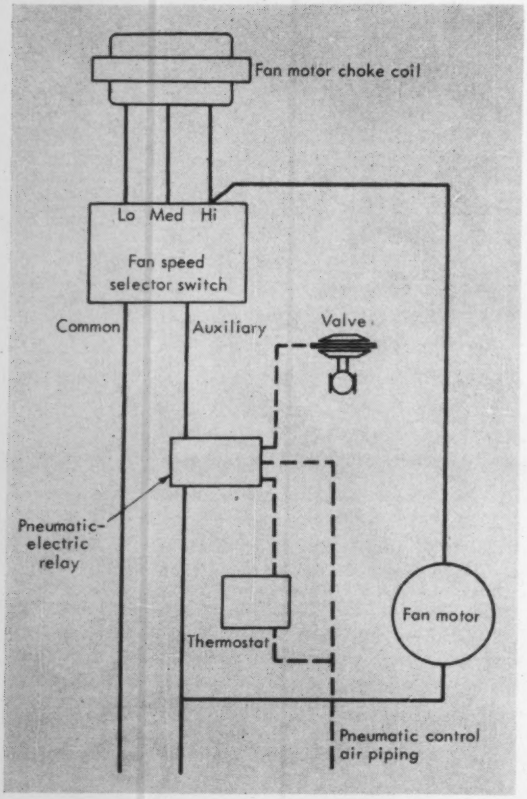


4 RETURN AIR THERMOSTAT can be used for non-ventilating applications if applied as shown here. Two-position valve of basic system is interlocked with fan (white) to provide positive valve shut off in accordance with fan operation, in a refinement to the basic control plan

The overlay of Fig. 4 shows a non-ventilating arrangement whereby the valve and fan may be cycled together on the thermostat. In winter, this minimizes the discharge of unheated room temperature air. Noise level with this arrangement will not be constant, and this may be objectionable at higher summer fan speeds.

Pneumatic Alternate

A pneumatic valve-continuous fan piping arrangement is shown in Fig. 5. With pneumatic controls, no interlock between the fan speed switch and the valve is used, as shown here, although this can be accomplished at additional cost. Without the interlock,


Fan motor choke coil
Lo Med Hi
Fan speed selector switch
Common
Auxiliary
Valve
Pneumatic-electric relay
Thermostat
Fan motor
Pneumatic control air piping

5 PNEUMATIC VALVE-continuous fan control system can be used. Fan-valve interlock could be added also

interior and cabinet condensation can occur when fans are off under manual speed control. Fans normally are not cycled on the thermostat with pneumatic control.

Finally, for non-ventilating applications, the fan may be operated continuously in summer and intermittently in winter. Fig. 6 shows such an arrangement. By cycling the fan with a coil-mounted fan switch in winter, two advantages are gained: a constant noise level during the cooling season when air requirements are high, and the preclusion of unheated room temperature air being discharged from the unit in winter. Again, such an arrangement will not be totally satisfactory for ventilating applications, due to non-continuous fan operation in winter.

Two-Way, Three-Way Valves

When valve control is used, a decision must be made as to whether two-way or three-way valves will be installed. Advantages of the three-way units include:

1) Full flow through the chiller is maintained at all times, allowing the chiller anti-freeze protector to do its job.

2) Stratification of water in large building mains is avoided. Such stratification can mean that certain units may not be supplied with chilled water during periods of low system demand.

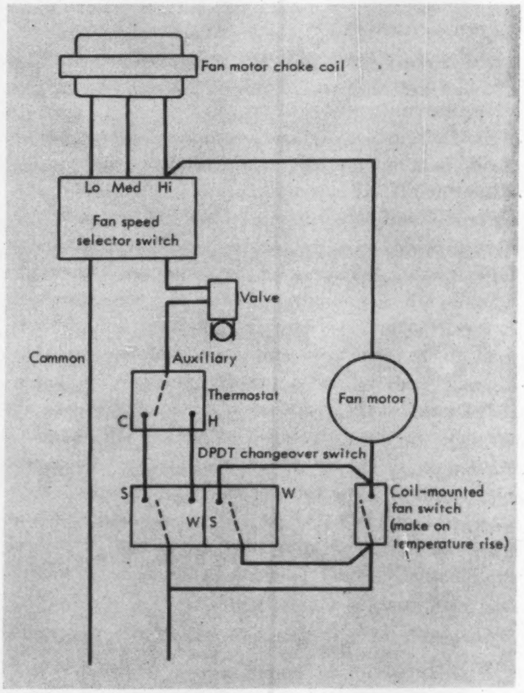
3) Continuously cold or hot pipes at the units are insured — allowing use of a pipe-mounted changeover switch at each unit.

While the above may seem to indicate shortcomings when applied to two-way valves, such disadvantages can be largely eliminated by connecting the far ends of the supply and return mains together through a pressure relief valve of proper size. In any event, full flow of water through the chiller must be maintained at all times to prevent chiller freeze-up.

Freeze Protection

Anti-freeze controls, as such, are not normally used on fan-coil units for ventilating applications, since the recommended maximum amount of outdoor air intake is about 25 percent. If this percentage is not exceeded, and if other precautions mentioned below are followed, anti-freeze control will be needed only in extremely cold climates.

An effective wind-compensating damper on the outdoor air intake can maintain the 25 percent outdoor air maximum limit even in the event of high winds or abnormal stack effect in the building. In


Fan motor choke coil
Lo Med Hi
Fan speed selector switch
Valve
Common
Auxiliary
Thermostat
C
H
Fan motor
DPDT changeover switch
S
W
W
S
Coil-mounted fan switch (make on temperature rise)

6 NON-VENTILATING control system shown here provides for continuous summer, intermittent winter operation, gives constant noise level when cooling, allows for minimum discharge of unheated air when heating. SPDT switch can also be used with this same arrangement addition, if the off position on the speed control switch is eliminated, proper mixing of outdoor and recirculated air will be assured.

If anti-freeze controls are used, they can operate when energized by excessive cold to insure that the valve, if used, is open; that the fan is on; and that the outdoor air damper, if motorized, is closed.

Control Water Temperature, Set Point

Modulating valves with modulated hot water temperature are preferred for ventilating applications, since the valve will normally be at least partially open in cold weather, preventing freeze-up. To make certain, the thermostat lower control point limit should be set as high as possible — say 65 F — to minimize the possibility of the room occupant shutting the valve for too long by setting the thermostat to its minimum setting.

On valve controlled ventilating applications in cold climates, where anti-freeze controls are not used, valves should have bleed holes drilled in the valve piece to insure some circulation at all times. If modulated water temperature in winter is used, mild weather overheating due to the bleed holes will seldom be a problem. If bleed holes are not used and the valves are automatically controlled, they should be so constructed as to open automatically in the event of power failure.

Summary: What to Provide

In summary, for best results on ventilating applications, modulating valve control with continuous fan operation should be used to avoid outdoor air blowing through the recirculated air intake during fan-off periods, and to insure that warmed air will be delivered to the room at all times. Modulated hot water temperature and the highest possible minimum thermostat setting should be used to insure as nearly as possible that some water flow exists at all times.

Ventilation rate must be controlled with an effective wind-compensating damper, and the off position on the speed control switch eliminated to insure mixing of the correct amount of outdoor air with a greater amount of room air. In cold climates, either anti-freeze controls or bleed holes in the valve piece should be used.

If fan control is used (with no valve) modulated hot water temperature should be used so that the fan will run most of the time, to insure delivery of warmed air to the room and the intake of outdoor air through the unit.

On applications where a constant ventilation rate is not required, the outdoor air damper may be closed manually in cold weather.

When the number of control schemes presented here are combined with all the various summer-winter changeover methods, it is obvious that an uneconomical situation exists from the standpoint of control selection, installation, and maintenance. The best solution is a higher degree of standardization on control types and functions.

Toward such standardization, it seems reasonable to propose the following general criteria. Modulated hot water in winter ought to be included in all jobs. The hot water temperature should be maintained 10 to 20 F high for a given temperature to allow for pickup in the event the unit is inadvertently turned off, a window left open, etc. Modulated hot water temperature will prevent overheating of rooms in mild winter weather due to gravity effect when fan control is used, and will allow for quick changeover from heating to cooling.

Summer-winter changeover should be automatic at the unit by means of a strap-on water temperature sensing switch having an effective differential of 20 F maximum. ⌖

Four Recommended Methods of Controlling Fan-Coil Units

1) Basic Manual Control: Manual water valve with end switch. No thermostat. Applicable to ventilating (with valve piece bleed hole and wind compensating damper) or non-ventilating requirements. Winter temperature control approximated by modulated water temperature.

2) Basic Automatic Control: As in (1) above, but with staged thermostatic control of fan in summer and on-off fan control for winter. Suitable for ventilating applications if modulated hot water temperature, bleed holes, and compensating damper are used.

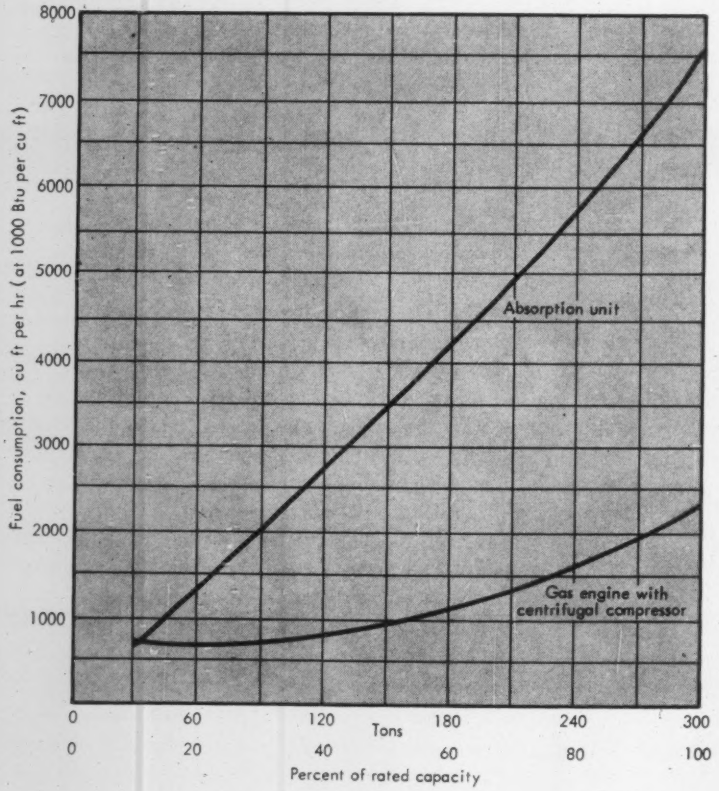
3) Overhead-Unit Control: Automatic valve control with continuous fan operation. This method also constitutes a refinement of the basic automatic control plan in (2), above. Requires wind compensating damper and anti-freeze controls or valve bleed hole in cold climates.

4) Advanced Automatic Control: Modulating control valve with fan switch interlock — provides continuous flow of cool or warm air, prevents drafts due to ventilation, and allows for satisfactory humidity control. Useable for either ventilating or non-ventilating applications, and can be used for either horizontal or vertical units. Anti-freeze controls required for ventilating applications in cold climates.

How to go about deciding on a prime mover in an air conditioning system design — make a careful cost analysis on available fuels, expected maintenance, and the kind of operation to be handled — analyze the system by parts, and as a whole — consider "compatibility" within the system, and in relation to space, noise, and access restrictions of the building.

This kind of investigation may reveal decided advantages in . . .

Using Natural Gas Engines As Air Conditioning Prime Movers



1 FUEL EFFICIENCY is important factor in drive or power selection. Curve at left indicates gas engine would use less fuel than aborption unit throughout most of operating range. Balancing factor would be first cost which might be lower for absorption system

By JACK H. GILL
Staff Engineer
Engine Division
Caterpillar Tractor Co.

IN THIS ARTICLE we will explore the general subject of selecting and applying natural gas engines as prime movers for air conditioning equipment.

The subject can be easily divided into three areas of interest:

1) The kind of performance a gas engine should be capable of delivering to be acceptable as power for conventional equipment or for heat pumps,

2) What the purchaser can justifiably expect from natural gas engine power, and

3) What to consider when selecting and applying gas engines.

As is true with any mechanical component, a gas engine, to be included in a system design, ought to offer some economic advantages, the capability of completely automatic operation, acceptable reliability, and compatibility with the driven equipment and with the environment in which the engine is to operate.

Economics of Gas Engine Power

A sensible power cost analysis is certainly a "must item" in the appraisal of any proposed air conditioning system. Data may be assembled in any form that will provide the answers we seek, but it is important that the analysis will develop

1) The cost of fuel, and the extension of that value to the cost of supplying power — for instance for steam, electricity, etc., and

2) The complete maintenance cost per ton-hour for the prime mover.

The sum of these two is essentially the operating cost. Fixed charges must also be considered, but these are familiar additions which will be known to the designer of the individual system.

Table Shows Typical Cost Analysis

Table 1 is a simple power cost analysis for a natural gas engine driven air conditioning system of 200 ton cooling capacity. This Table is representative only; used to illustrate the kind of analysis that can be easily made for a comparison with other methods in any location.

The value of 40 cents per 1000 cu ft (4 cents per therm) for fuel cost is arbitrary to the extent that the figure will vary in different regions depending upon the availability of gas. Our figure is, however, a pseudo "average," suitable for our demonstration.

Against the values of Table 1, calculations for other fuels (for other types of systems) would be entered to complete the analysis, and again, these latter values will vary according to location — for instance the Kwh costs for electricity, etc.

TABLE 1 — COST ANALYSIS for natural gas engine driven air conditioning system should include factors listed below, with representative values, which can be compared with costs for systems using other fuels and components. Thorough investigation of this kind in light of availability and service conditions which exist in any one location will help insure selection of most economical, efficient system

Power cost analysis	
Maximum compressor capacity, tons	200
Maximum load (1 hp per ton)	200
Average load (per season)	150
Average hrs per yr	4000
Fuel cost (gas) per 1000 cu ft (1000 Btu LHV)	$0.40
Operating cost	
Specific fuel consumption, cu ft per hp per hr	8
Fuel used per hr, cu ft (150 X 8)	1200
Fuel cost per hr 1200/1000 X $0.40	$0.48
Total maintenance cost per hr (engine)	$0.218
Total operating cost per hr ($0.48 + $0.218)	$0.698
Power cost per ton per hr ($0.698/150)	$0.00465

Consider Fuel Efficiency

As an extension of this analysis, Fig. 1 shows a comparison of the fuel consumption rate for a gas engine driven centrifugal compressor *vs* an absorption system. In this case, (300 ton capacity compressor) the consumption rate for the gas engine remains substantially lower throughout most of the operating range. Thus, the efficient use of the fuel available is also a pertinent factor in the cost analysis.

Then, Other Cost Factors

Fuel consumption alone doesn't constitute a complete analysis. For instance, the initial cost of the absorption unit considered in Fig. 1 might be lower than the cost of the gas engine system, especially if the absorption installation can utilize existing steam capacity.

The point is, as always, that in the light of existing conditions of supply, fuel availability, and so forth, gas engines can and should be considered through a careful investigation with realistic estimates.

Be Sure of Your Data

The arithmetic of such analysis is simple enough, and the conclusions self explanatory. However, the

gas engine drives for air conditioning

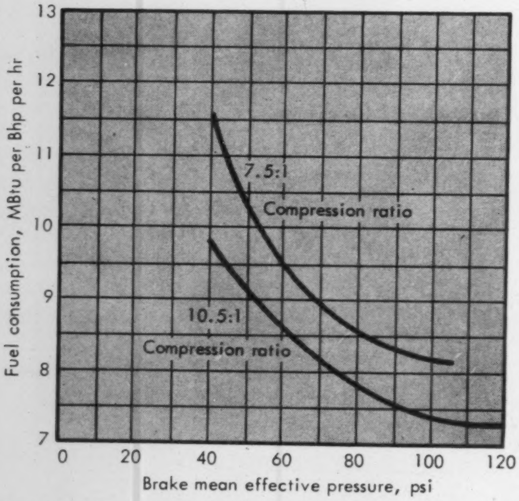
analysis will be no better than the data upon which it is based. For the engine portion, *specific* fuel consumption is a most important item. Since fuel cost is the major part of total operating cost, this should be explored thoroughly.

Consider Engine Design

Fuel economy is simply a function of thermal efficiency of the engine, assuming good carburetion and ignition, and thermal efficiency is in turn directly proportional to the compression ratio of the engine. Thus, considering the fuel to be used (say commercial pipeline natural gas) the designer would seek to equate all engine features, and particularly the listed compression ratio, to determine what kind of efficiency he can expect. Generally speaking, the trend of modern engine design is toward higher compresssion ratios. This is all by way of requiring a well defined specific fuel consumption from any engine considered.

Higher CR Should Save Fuel

The effect of higher compression ratios on fuel consumption (all things being equal) is illustrated in Fig. 2, for an engine operating at 1200 rpm. Note that at maximum output an increase in compression ratio from 7.5:1 to 10.5:1 results in a fuel consumption advantage of 1000 Btu per hp per hr (8200 to 7200 Btu per hr).



2 RAISING COMPRESSION RATIO on 1200 rpm engine results in fuel saving as seen here

Lower compression ratios are used on other-than-methane gases containing appreciable amounts of hydro-carbons heavier than propane, where detonation would otherwise be a problem.

Study Varying Load Effects

To fully understand what sort of fuel economy can be expected from a gas engine, the engineer should obtain, for any engine considered, a "part load" fuel curve or preferably a family of curves such as illustrated in Fig. 3.

In Fig. 3, note that at constant speed, as the load is increased there is a material improvement in the specific fuel consumption. Conversely, at light loads, fuel consumption is relatively high. A study of such curves for a number of engines considered will aid in selecting the proper unit, compatible with other components of the system, for the job at hand.

Next Step Is System Integration

While all these fuel consumption values are absolutely essential to engine selection, they still don't represent the complete answer to the problem of insuring the lowest total fuel consumption per season. Many other factors will have an obvious effect on economy, among which will be success in

1) Matching engine to load, and
2) Selecting proper controls.

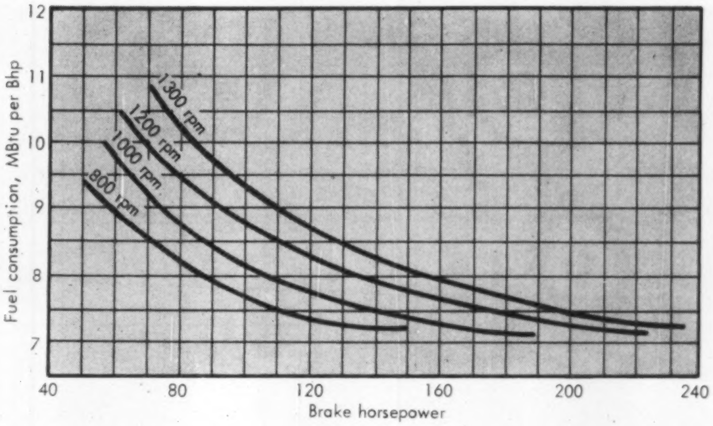
Matching Engine to Load

It is a not-uncommon assumption that by applying a large engine to a small load, savings in maintenance costs will be assured. This is dangerous. In the first place, any piece of equipment must in time be repaired or overhauled, and generally speaking, the prices of like parts for engines of different sizes follow the pattern of "large part — large price." Therefore the temptation to "overpower" should be tempered by a maintenance cost analysis for several engine sizes, which will yield the size of the price tag for overpowering.

In any event, a parts price list for all major parts or assemblies that might be required for a complete overhaul ought to be checked for any engine which is considered.

In some instances, the initial cost of the engine may be reduced to secondary importance when an installation is evaluated on the basis of total cost over a 10 or 20 yr period.

Secondly, the "large engine — small load" design is a practical guarantee of part-load operation, with



3 PART LOAD fuel curves for single engine show improvement in fuel consumption as load increases. Similar curves for all engines considered should be compared

the accompanying evil of poor fuel economy. It is quite possible, then, that overpowering a job can be as costly as underpowering, though perhaps not as troublesome.

Selecting Proper Controls

There are two basic methods of controlling compressor output to match the cooling demand; excluding of course the "on-off" method used for very small units. Either the compressor can be maintained at constant speed, and output regulated by controlling the flow rate of gas through the compressor, or compressor and engine speed can be modulated to control the amount of gas compressed. Modulating engine speed from 100 percent to about 75 percent of rated operating speed will change the output of a centrifugal compressor from 100 percent capacity to about 30 percent. Further reduction of output is usually accomplished by use of a vane type control to regulate the flow of gas to the compressor.

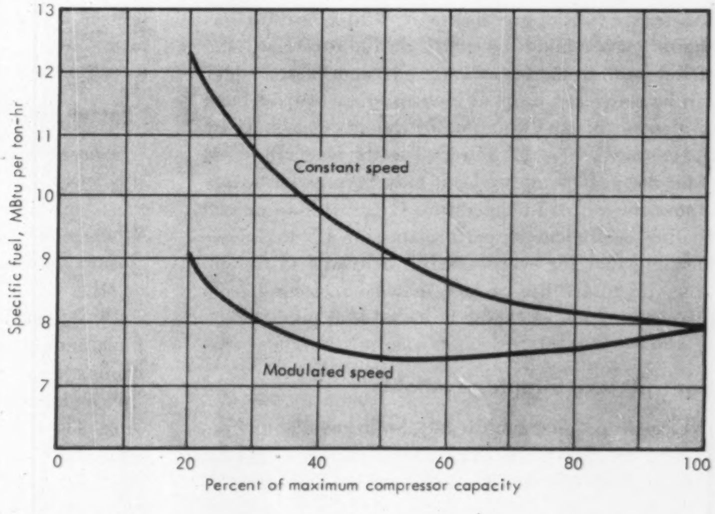
For a reciprocating compressor, the speed is usually modulated through a much broader range, since the output of this type bears more of a straight line relationship to the operating speed.

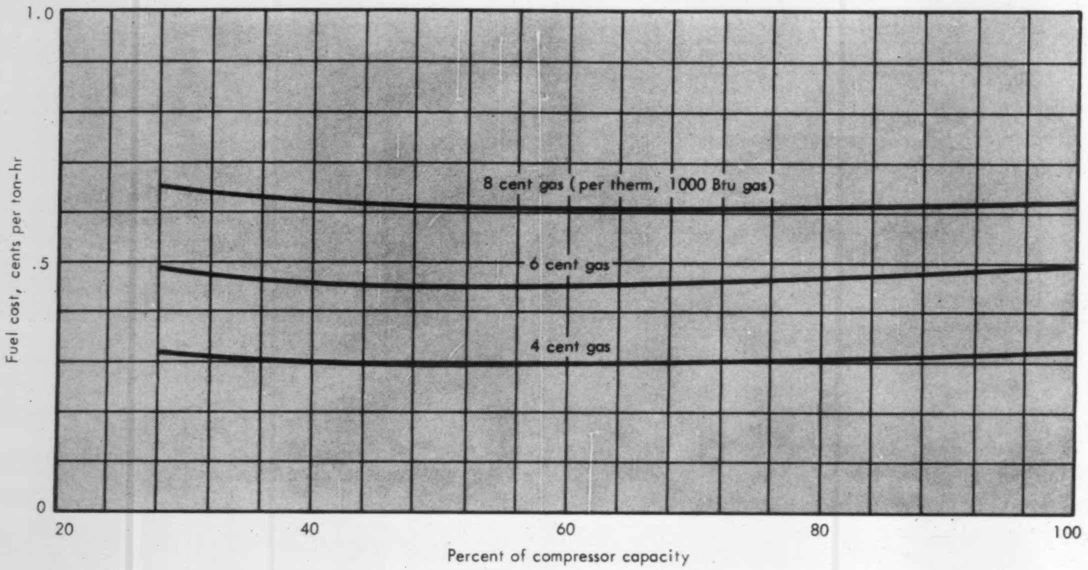
Choosing Modulation or Constant Speed

The question of constant *vs* modulated speed as regards the effectiveness of air conditioning control will have to be resolved by the system designer. However, it will be well to consider the two possibilities from the standpoint of fuel consumption when gas engine power is used. Referring again to the specific fuel curves in Fig. 3, note on any one of the curves what happens to fuel consumption as the speed remains constant and the load is reduced. Consumption per hp per hr increases quite rapidly. When engine speed is changed to match the load, however, the engine is permitted to operate near its rated output for the respective speed — which means at or near the optimum specific fuel rate. In some cases, the specific fuel consumption per horsepower per hr will actually improve as the load and speed are reduced simultaneously.

The engine, however, operates as part of a com-

4 COMPARISON CURVES showing fuel consumption at constant and modulated engine-compressor speeds indicate sizeable advantage with modulated speed well up into higher operating range





5 FUEL COST per ton of capacity curves shown here are translation of modulated speed curve of Fig. 4, show a nearly uniform relative fuel cost over entire operating range of gas engine — indicating both part and full-load efficiency

pressor package, and it is the efficiency of the whole unit that is the prime concern. Fig 4 illustrates the effect of modulated speed on an engine-compressor unit, with the differential between the two curves indicating a substantial advantage in fuel consumption for modulated speed units well up into the higher operating levels.

The modulated speed curve of Fig. 4 is translated into fuel cost per ton capacity per hour in Fig. 5, in which it can be seen that cost of operation should remain nearly uniform over the entire operating range of the unit.

Gas Engines and Heat Pumps

If system air conditioning equipment is to be operated as a heat pump to provide winter heating, gas engine power may be particularly attractive. Rejected heat from the exhaust gas and jacket water can be recovered in quantities up to an equivalent of 45 percent of the Btu value of the gas consumed by the engine. When this is added to the heat recovered from the heat pump cycle, it may be possible to operate over a broad temperature range with an overall heating coefficient of performance of 1.5 to 1.7 — meaning that for every gas Btu delivered to the engine, 1.5 to 1.7 Btu of heat may be recovered from the combination of engine heat and heat pump effect.

Controls Are Simple, Available

Electric or pneumatic controls are available from various manufacturers to do a wide variety of gas engine operating tasks. Engines can be automatically started and stopped, either on a pre-set time schedule or on demand. Engine speed modulating controls are likewise available. Packaged control units are generally offered along with the engines selected for air conditioning duty.

The Question of Compatibility

Finally, as the whole design begins to take shape, it must be remembered that the natural gas engine, along with all other components, must operate within the limitations of the whole system, and within the confines of the place where it is used.

Torsional vibration does exist, and any combination of engine, coupling, speed increaser if used, and compressor must be free of serious torsionals. Compressor and engine manufacturers will offer counsel to the designer on this problem.

Special Gas Engine Provisions

Noise control is another factor in determining compatibility. Machinery generates noise, which must be reduced or contained to an acceptable level. Where noise is likely to be a problem, a separate enclosure for engine and compressor may be required, or other noise control measures can be taken.

Design plans must also provide for exhaust muffling and disposal, engine air intake, engine room cooling and ventilation, adequate vibration mounting, and a heat exchanger cooling system for the engine. These will constitute additional space requirements and added equipment selections to insure an efficient overall design. ∓

Sectional Committee Interprets Code for Nuclear Piping

Since the Code for Pressure Piping, ASA B31.1-1955 was last issued, the Sectional Committee on the Code has been asked to interpret various statements contained therein. While the replies to such inquiries represent the opinion of the committee, they will not become parts of the Code until formal action has been completed.

Cases N-11 and N-12 reported here deal with the allowable means to provide thermal expansion in nuclear piping systems, and the procedure for qualifying new materials for use in nuclear piping systems, respectively.

Case No. N-11 (Reopened)

Inquiry: What means may be used to provide thermal expansion in nuclear piping systems?

Reply: It is the opinion of the committee that any sound means of providing for thermal expansion may be used. It is recommended that these means be provided by plain or corrugated pipe bends, offsets, changes in direction of the pipe line itself, or bellows expansion joints. Whatever means are used must meet the following requirements:

1) Provision for expansion must meet the requirements of ASA B31.1-1955, Section 6, Chapter 3.

2) Be of materials recognized by ASA B31.1 and Code cases prefixed by *N* as satisfactory for the specified conditions.

3) If of a sliding or swivel type have a positive seal or a leakoff which reasonably assures that the leakoff will be contained within the main or auxiliary nuclear piping systems.

4) The designer is cautioned to provide for unusual thermal expansion due to rapid temperature fluctuations, especially in liquid metal piping systems.

Case No. N-12

Inquiry: What is the procedure for qualifying new material for use in nuclear piping systems?

Reply: The qualification procedure for materials whether new or commercially available in nuclear piping systems has been established as one of the standards by the Committee on Nuclear Piping of ASA B31. The procedure is believed to be a uniform method of handling inquiries and working stress determinations. The procedure which follows incorporates criteria that are presently accepted for high-pressure steam piping as well as nuclear requirements that appear to be pertinent for material acceptance.

1) *ASTM Identification.* It is desirable that the material be identified with an ASTM Standard Specification or an ASTM Tentative Specification. If the material varies only slightly from an ASTM Specification by the addition, for example, of a small amount of alloying element, it should be stated that the material will comply with that Specification except as noted. The exception should be stated as to chemical composition and to mechanical properties based on test results and tensile data.

2) *Alternate Identification.* If no ASTM Specification can be applied, the following information shall be given in the same form as used by the ASTM giving ranges of values within which it is commercially practical to reproduce the material rather than an exact determination of the properties.

(a) Chemical composition showing all significant alloying elements including for ferrous material, carbon, manganese, phosphorus, sulfur and silicon, together with alloying elements, if any. The maximum content of the following residual elements shall also be furnished: cobalt, tantalum, and boron.

(b) Ultimate tensile and yield properties, over the temperature range of contemplated service. Where the materials are to be stress-relieved or heat-treated, the tensile tests shall be made after the specimens are similarly treated.

3) *Creep and Stress Rupture Data*

(a) Creep strength over any temperature range of contemplated service within which creep will lower the working strength of the material.

(b) The stress-rupture strength over any temperature range within which the material might fail by rupturing.

(c) Basis for establishing stress values may be found in Paragraph A-150 ASME Boiler and Pressure Vessel Code Section I, (1959).

4) *Physical Properties*

(a) In the case of materials of which no previous use in any form or similar analysis has been had in nuclear service, the specific heat, the coefficient of thermal conductivity, and the coefficient of thermal expansion shall be furnished when the material is intended for use in nuclear services where it may be subjected to severe thermal shocks.

5) *Heat Treatment.* Any heat treatment required to produce the specified tensile properties shall be described.

6) *Hardness Measurements.* The Brinell or Rockwell hardness of the material, in the state in which it will be used, shall be given unless this information is well known.

7) *Impact Strength and Transition Temperature.* If the material is to be used at low temperatures, below −20 F, the impact strength at the lowest temperature to which it will be subjected, or at some lower temperature, shall be given. The impact strength shall be determined in accordance with the requirements of Par. UG-84 of Section VIII of the ASME Boiler and Unfired Pressure Vessel Code, or "V" notch data. It is also suggested that the material transition temperature for percent ductile fracture, energy absorbed, and lateral expansion plotted against temperature, and any other pertinent data be furnished using impact testing methods outlined in UG-84 specified above.

8) *Radiation and Temperature Effects.* It is important to state whether the new material is subject to critical changes in physical and mechanical characteristics caused by irradiation or by temperatures within the range of use or fabrication. By this is meant a marked change in brittleness, hardness, ductility, impact strength, grain size, etc.

9) *Microstructure Variations.* It should also be stated whether the material is subject to age-hardening or critical structural changes by a combination of physical and temperature conditions, such, for example, as the age-hardening of certain aluminum alloys after cold-working and subsequent heat treatment. This is particularly important for conditions which may occur during fabrication that result in such critical changes.

10) *Availability.* It should be stated whether the material is commercially available and can be purchased within the specified range of chemical composition and mechanical properties. If the material is covered by patents so that it cannot be manufactured by anyone who wishes to use it without securing a license or paying royalties, it should be so stated.

11) *Weldability*

(a) If the material is to be welded, it should be stated whether any special procedure is required for arc or gas welding and the amount of experience available for determining the weldability. It should also be stated whether the material is subject to air-hardening during welding. If a special procedure must be followed in welding the material, or if the weldment must be pre-heated, stress-relieved or heat-treated after welding, the procedure should be specified, including the proper temperatures.

(b) It is recommended that the tests described in Section IX of the ASME Boiler and Unfired Pressure Vessel Code or their equivalent be made, unless equivalent information is available.

12) *Test Results.* Tests, results of which are submitted to the Piping Code Committee, should be made on representative thicknesses of materials contemplated, in accordance with ASTM testing methods. ‡

Tables for Calculating Weights of Sheet Metal Ducts

By WILLIE HAMMER
Mechanical Engineer

THE TABLES on this and the following page will enable the engineer to read directly the weight, in lb per lineal ft, of galvanized ducts in sizes 6 in. by 32 in. up to 84 in. by 84 in. Similar tables published as the October, 1961 HPAC Data Sheet gave weights for ducts 3 in. by 3 in. up to 30 in. by 30 in.

The Tables have been prepared for low pressure systems using galvanized iron in gages as recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers *Guide*.

Each weight Table is followed by a Table of conversion factors by which to multiply a given weight value when different gages of metal will be used, or for different materials (black iron, aluminum), either for medium or high pressure systems or when special rigidity is required. ‡

TABLE 3 — WEIGHTS OF RECTANGULAR GALVANIZED IRON DUCTS (lb per lineal ft) for duct sizes 6 in. by 32 in. to 54 in. by 54 in., 22 gage U.S. Std (1.406 lb per sq ft). Add 15 percent to given weights to cover seams, connectors, hangers, slips, scrap, and duct end closing pieces. Calculate bracing and stiffening separately

Sides (in.)	32	34	36	38	40	42	44	46	48	50	52	54
6	8.90	9.37	9.84	10.3	10.8	11.3	11.7	12.2	12.7	13.1	13.6	14.1
7	9.14	9.61	10.1	10.5	11.0	11.5	12.0	12.4	12.9	13.4	13.8	14.3
8	9.37	9.84	10.3	10.8	11.3	11.7	12.2	12.7	13.1	13.6	14.1	14.5
9	9.61	10.1	10.5	11.0	11.5	12.0	12.4	12.9	13.4	13.8	14.3	14.8
10	9.84	10.3	10.8	11.3	11.7	12.2	12.7	13.1	13.6	14.1	14.5	15.0
11	10.1	10.5	11.0	11.5	12.0	12.4	12.9	13.4	13.8	14.3	14.8	15.2
12	10.3	10.8	11.3	11.7	12.2	12.7	13.1	13.6	14.1	14.5	15.0	15.5
13	10.5	11.0	11.5	12.0	12.4	12.9	13.4	13.8	14.3	14.8	15.2	15.7
14	10.8	11.3	11.7	12.2	12.7	13.1	13.6	14.1	14.5	15.0	15.5	15.9
15	11.0	11.5	12.0	12.4	12.9	13.4	13.8	14.3	14.8	15.2	15.7	16.2
16	11.3	11.7	12.2	12.7	13.1	13.6	14.1	14.5	15.0	15.5	15.9	16.4
18	11.7	12.2	12.7	13.1	13.6	14.1	14.5	15.0	15.5	15.9	16.4	16.9
20	12.2	12.7	13.1	13.6	14.1	14.5	15.0	15.5	15.9	16.4	16.9	17.3
22	12.7	13.1	13.6	14.1	14.5	15.0	15.5	15.9	16.4	16.9	17.3	17.8
24	13.1	13.6	14.1	14.5	15.0	15.5	15.9	16.4	16.9	17.3	17.8	18.3
26	13.6	14.1	14.5	15.0	15.5	15.9	16.4	16.9	17.3	17.8	18.3	18.7
28	14.1	14.5	15.0	15.5	15.9	16.4	16.9	17.3	17.8	18.3	18.7	19.2
30	14.5	15.0	15.5	15.9	16.4	16.9	17.3	17.8	18.3	18.7	19.2	19.7
32	15.0	15.5	15.9	16.4	16.9	17.3	17.8	18.3	18.7	19.2	19.7	20.2
34	15.5	15.9	16.4	16.9	17.3	17.8	18.3	18.7	19.2	19.7	20.2	20.6
36	15.9	16.4	16.9	17.3	17.8	18.3	18.7	19.2	19.7	20.2	20.6	21.1
38	16.4	16.9	17.3	17.8	18.3	18.7	19.2	19.7	20.2	20.6	21.1	21.6
40	16.9	17.3	17.8	18.3	18.7	19.2	19.7	20.2	20.6	21.1	21.6	22.0
42	17.3	17.8	18.3	18.7	19.2	19.7	20.2	20.6	21.1	21.6	22.0	22.5
44	17.8	18.3	18.7	19.2	19.7	20.2	20.6	21.1	21.6	22.0	22.5	23.0
46	18.3	18.7	19.2	19.7	20.2	20.6	21.1	21.6	22.0	22.5	23.0	23.4
48	18.7	19.2	19.7	20.2	20.6	21.1	21.6	22.0	22.5	23.0	23.4	23.9
50	19.2	19.7	20.2	20.6	21.1	21.6	22.0	22.5	23.0	23.4	23.9	24.4
52	19.7	20.2	20.6	21.1	21.6	22.0	22.5	23.0	23.4	23.9	24.4	24.8
54	20.2	20.6	21.1	21.6	22.0	22.5	23.0	23.4	23.9	24.4	24.8	25.3

CONVERSION FACTORS (gages for iron are U.S. Std; for aluminum, Browne & Sharpe)

For	Material	Gage	Lb per sq ft	Factor
Low pressure (to 1-½ in. WG)	Black iron	22	1.250	0.889
	Aluminum	20	0.452	0.321
Medium pressure (1-½ to 4 in. WG)	Galvanized iron	20	1.656	1.178
	Black iron	20	1.500	1.067
Or for special stiffness or rigidity	Aluminum	18	0.563	0.400
High pressure (4 to 8 in. WG)	Galvanized iron	18	2.156	1.533
	Black iron	18	2.000	1.422

TABLE 4 — WEIGHTS OF RECTANGULAR GALVANIZED IRON DUCTS (lb per lineal ft) for duct sizes 10 in. by 56 in. to 84 in. by 84 in., 20 gage U.S. Std (1.656 lb per sq ft). Add 15 percent to given weights to cover seams, connectors, hangers, slips, scrap, and duct end closings. Bracing and stiffening should be calculated separately

Sides (in.)	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84
10	18.2	18.8	19.3	19.9	20.4	21.0	21.5	22.1	22.6	23.2	23.7	24.3	24.8	25.4	25.9
11	18.5	19.0	19.6	20.1	20.7	21.3	21.8	22.4	22.9	23.5	24.0	24.6	25.1	25.7	26.2
12	18.8	19.3	19.9	20.4	21.0	21.5	22.1	22.6	23.2	23.7	24.3	24.8	25.4	25.9	26.5
13	19.0	19.6	20.1	20.7	21.3	21.8	22.4	22.9	23.5	24.0	24.6	25.1	25.7	26.2	26.8
14	19.3	19.9	20.4	21.0	21.5	22.1	22.6	23.2	23.7	24.3	24.8	25.4	25.9	26.5	27.0
15	19.6	20.1	20.7	21.3	21.8	22.4	22.9	23.5	24.0	24.6	25.1	25.7	26.2	26.8	27.3
16	19.9	20.4	21.0	21.5	22.1	22.6	23.2	23.7	24.3	24.8	25.4	25.9	26.5	27.0	27.6
18	20.4	21.0	21.5	22.1	22.6	23.2	23.7	24.3	24.8	25.4	25.9	26.5	27.0	27.6	28.2
20	21.0	21.5	22.1	22.6	23.2	23.7	24.3	24.8	25.4	25.9	26.5	27.0	27.6	28.2	28.7
22	21.5	22.1	22.6	23.2	23.7	24.3	24.8	25.4	25.9	26.5	27.0	27.6	28.2	28.7	29.3
24	22.1	22.6	23.2	23.7	24.3	24.8	25.4	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.8
26	22.6	23.2	23.7	24.3	24.8	25.4	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.8	30.4
28	23.2	23.7	24.3	24.8	25.4	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.8	30.4	30.9
30	23.7	24.3	24.8	25.4	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.8	30.4	30.9	31.5
32	24.3	24.8	25.4	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.0
34	24.8	25.4	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.0	32.6
36	25.4	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1
38	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1	33.7
40	26.5	27.0	27.6	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1	33.7	34.2
42	27.0	27.6	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1	33.7	34.2	34.8
44	27.6	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1	33.7	34.2	34.8	35.3
46	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1	33.7	34.2	34.8	35.3	35.9
48	28.7	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1	33.7	34.2	34.8	35.3	35.9	36.4
50	29.3	29.8	30.4	30.9	31.5	32.0	32.6	33.1	33.7	34.2	34.8	35.3	35.9	36.4	37.0
52	29.8	30.4	30.9	31.5	32.0	32.6	33.1	33.7	34.2	34.8	35.3	35.9	36.4	37.0	37.5
54	30.4	30.9	31.5	32.0	32.6	33.1	33.7	34.2	34.8	35.3	35.9	36.4	37.0	37.5	38.1
56	30.9	31.5	32.0	32.6	33.1	33.7	34.2	34.8	35.3	35.9	36.4	37.0	37.5	38.1	38.6
58	31.5	32.0	32.6	33.1	33.7	34.2	34.8	35.3	35.9	36.4	37.0	37.5	38.1	38.6	39.2
60	32.0	32.6	33.1	33.7	34.2	34.8	35.3	35.9	36.4	37.0	37.5	38.1	38.6	39.2	39.7
62	32.6	33.1	33.7	34.2	34.8	35.3	35.9	36.4	37.0	37.5	38.1	38.6	39.2	39.7	40.3
64	33.1	33.7	34.2	34.8	35.3	35.9	36.4	37.0	37.5	38.1	38.6	39.2	39.7	40.3	40.8
66	33.7	34.2	34.8	35.3	35.9	36.4	37.0	37.5	38.1	38.6	39.2	39.7	40.3	40.8	41.4
68	34.2	34.8	35.3	35.9	36.4	37.0	37.5	38.1	38.6	39.2	39.7	40.3	40.8	41.4	42.0
70	34.8	35.3	35.9	36.4	37.0	37.5	38.1	38.6	39.2	39.7	40.3	40.8	41.4	42.0	42.5
72	35.3	35.9	36.4	37.0	37.5	38.1	38.6	39.2	39.7	40.3	40.8	41.4	42.0	42.5	43.1
74	35.9	36.4	37.0	37.5	38.1	38.6	39.2	39.7	40.3	40.8	41.4	42.0	42.5	43.1	43.6
76	36.4	37.0	37.5	38.1	38.6	39.2	39.7	40.3	40.8	41.4	42.0	42.5	43.1	43.6	44.2
78	37.0	37.5	38.1	38.6	39.2	39.7	40.3	40.8	41.4	42.0	42.5	43.1	43.6	44.2	44.7
80	37.5	38.1	38.6	39.2	39.7	40.3	40.8	41.4	42.0	42.5	43.1	43.6	44.2	44.7	45.3
82	38.1	38.6	39.2	39.7	40.2	40.8	41.4	42.0	42.5	43.1	43.6	44.2	44.7	45.3	45.8
84	38.6	39.2	39.7	40.2	40.8	41.4	42.0	42.5	43.1	43.6	44.2	44.7	45.3	45.8	46.4

CONVERSION FACTORS (gages for iron are U.S. Std; for aluminum, Browne & Sharpe)

For	Material	Gage	Lb per sq ft	Factor
Low pressure (to 1-½ in. WG)	Black iron	20	1.500	0.906
	Aluminum	18	0.563	0.340
Medium pressure (1-½ to 4 in. WG)	Galvanized iron	18	2.156	1.302
	Black iron	18	2.000	1.208
Or for special stiffness or rigidity	Aluminum	16	0.720	0.435
High pressure	Galvanized iron	16	2.656	1.604
(4 to 8 in. WG)	Black iron	16	2.500	1.510

HPAC ENGINEERING DATA FILE

CORROSION
Its Nature and Control

- *What is corrosion?*
- *What controls its rate?*
- *What kinds of attack occur?*
- *What ways to control it?*

Corrosion of piping systems and other metallic structures consumes a considerable portion of the gross national product with total direct costs variously estimated at approximately 6 billion dollars. Such direct costs include loss of equipment, cost of control measures, and labor. Not included are indirect costs such as loss of product, injury, and loss of property and life which may accompany a corrosion caused failure.

Corrosion and the complications arising from it are among the prime causes of the need for preventive maintenance. Recognition of the symptoms and an understanding of the causes of corrosion can lead to a reduction of preventive maintenance requirements. In this report, information relative to the nature of corrosion is provided which will aid in diagnosing corrosion problems. Methods of control are also suggested.

The editors wish to acknowledge the assistance of the following engineers who reviewed the report and suggested valuable additions to it:

W. H. Bruckner, professor of metallurgical engineering, University of Illinois.

H. R. Copson, supervisor, corrosion section, International Nickel Co., Inc., research laboratory.

S. Sussman, chemical engineer, Water Services Laboratory.

Fundamentals of Corrosion, What It Is And How to Control It

CORROSION technically is the "wearing away" or destruction of a metal either by chemical or electrochemical action or a combination of the two. From a practical standpoint, it is an economic loss which includes the costs related to premature loss of material and equipment, and the cost of control measures. Under some circumstances if allowed to continue unabated until the system fails, corrosion may indirectly result in property damage, loss of life, or both.

Corrosion control fundamentally involves an engineering balance of the costs of anticipated corrosion losses with the costs of control measures during a system's life. In some cases, the exacting demands of a process may require that corrosion be eliminated entirely. However, corrosion losses must often be permitted to continue but at reduced and controlled rates because absolute control usually is not economically feasible.

Much systematic study has been devoted to corrosion and its control in recent years and much is in progress. To provide adequate control, knowledge of conditions encouraging corrosion and the mechanisms by which it proceeds is required. In this report, these aspects of corrosion and ways to control it are presented.

What Are the Mechanisms?

Corrosion commonly encountered in practice as noted earlier is the result of chemical action, but the rate of this action is influenced by many factors in the environmental conditions. Physical action of the corrodent, the corroding member, or a chemically inert foreign material acts to modify — often increasing — the chemical action. Interaction of the various factors affecting corrosion must always be considered since they rarely act independently in any given situation.

Corrosion which results from chemical action is electrochemical as electron transfer is an integral and necessary part of the process. Thus, an understanding of electrochemical principles is fundamental in the study of corrosion.

What Constitutes the Corrosion Cell?

The basic electrochemical cell consists of three essential components:

1) Anodic and cathodic areas on the metal surface at which separate anode and cathode reactions can take place. The metal provides a low resistance path for current flow.

2) An electrolyte through which an electric current can flow to complete the electric circuit, and

ELECTROMOTIVE FORCE SERIES given here in part indicates tendency for metals to go into solution when in contact with an electrolyte. Metals high in the list have greater "solution pressure" than those low on the list. Thus, when two metals are placed in contact in an electrolyte, the one highest on the list will tend to corrode. It should be noted, however, the nature of the electrolyte may reverse the relative positions of the metals in the EMF séries

Corroded end (anodic or least noble)

Magnesium
Aluminum
Manganese
Zinc
Chromium
Iron
Cadmium
Nickel
Tin
Lead
Copper
Silver
Platinum
Gold

Protected end (cathodic or most noble)

3) A potential or voltage difference between the anodic and cathodic areas. The driving force in the corrosion process is the free energy change of the chemical reaction which can be expressed in volts. The chemical reaction can be divided into anodic and cathodic parts, which take place at the anodic and cathodic areas and establish potential differences.

At the anodes, positively charged metal ions go into solution as the metal is oxidized. As these positive ions break away from the surface, electrons remain behind. The excess electrons flow from the anodes to the cathodes through the metal structure. At the cathodes, the electrons reduce the corroding medium — the electrolyte. A current flows in the electrolyte from cathode to anode that is equal to that flowing in the metal.

Solution Pressure

All metals when immersed in aqueous solutions or water, tend to dissolve. This tendency for metals to go into solution is conveniently referred to as solution pressure. Some metals tend to dissolve more readily than others.

Base metals such as iron, magnesium, and aluminum have high solution pressures, noble metals such as copper, gold, and silver have low solution pressures. Solution pressures are indicated in a general way by the Electromotive Force Series. However, the particular electrolyte involved in the corrosion cell may in some cases reverse the relative positions given in the EMF Series. When dissimilar metals are placed in contact, the cathode reaction will concentrate on the more noble metal and the anode reaction on the other metal, and the result is galvanic corrosion.

What Controls Corrosion Rate

Many factors modify the rate at which the corrosion reaction proceeds. Among them are, the nature of the electrolyte, temperature, pressure, and velocity of the electrolyte relative to the corroding surface. As current flows through the corrosion cell, the anodes and cathodes tend to polarize to the same potential in the absence of disturbing effects. Polarization opposes the reversible voltage of the corrosion cell, and thus, it is sometimes considered a "back" or counter electromotive force.

The various polarization effects that occur as given by Obrecht[1] include:

1) Voltage drop (iR) due to the electrical resistance of the electrolyte.

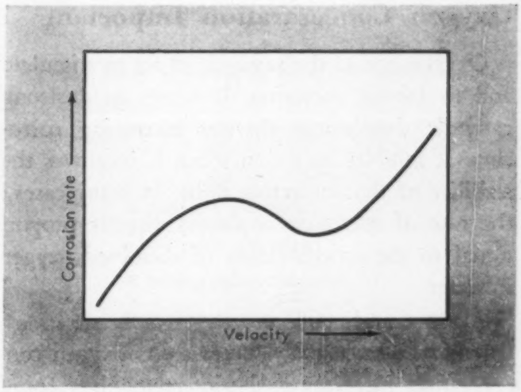
2) Voltage drop (iR) due to the electrical resistance of the internal circuit between the anode and cathode. This drop is usually small because the low resistance of the metal makes the corrosion circuit a short circuited cell.

3) Polarization either at the anode or cathode or both which consists of:

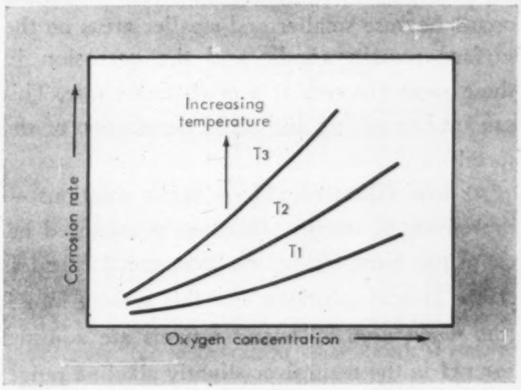
a) Concentration polarization — an increase

---

[1] *Numbers indicate references, page 172*



CORROSION tends to increase with velocity as shown here. In the low range, removal of corrosion product and replenishing supply of reactants causes increased corrosion. Dip in curve at intermediate velocities results when increase in velocity brings sufficient oxygen to metal to aid formation of protective films. Increasing corrosion at high velocities reflects effects of erosion which destroys protective films



OXYGEN CONCENTRATION and temperature affect corrosion rate as shown here. Generally, as either increases, corrosion rate increases. High oxygen concentrations can inhibit corrosion by improving stability of protective films but as films form, anodic areas decrease in size and pitting and rapid penetration of the metal may occur

of the metallic ion concentration in the vicinity of the anode, and either an increase of hydroxl ions formed in reduction of water or a decrease in the supply of oxygen or hydrogen ions at the cathode.

b) Resistance of films of corrosion product formed on the metal surface at the anode, and/or the cathode.

c) Overvoltage — This can be considered to include the polarization effects not attributable to concentration or film resistance. Overvoltage increases with current density and decreases with increases in temperature and roughness of the metal surface.

What Effect Has Velocity?

Consideration of the factors[2] contributing to polarization of the corrosion cell gives a qualitative insight into the effects of velocity on the corrosion rate. At low velocities of the electrolyte, the corrosion products are removed from the corroding surface and the supply of reactants such as oxygen and hydrogen ions is increased. In effect, velocity decreases polarization and increases the rate of corrosion when reactants are available in the electrolyte. At low velocities, the rate of corrosion will tend to increase with increasing velocity. At intermediate velocities, sufficient oxygen may be brought to the surface to aid in film formation thereby decreasing corrosion or at least retarding it.

At high velocities, physical action may become important if protective films are mechanically destroyed by erosion. Destruction of these films reduces polarization thereby increasing corrosion. In some cases, the "clean" area may become anodic to adjoining surfaces where the film remains intact, thus initiating corrosion where none had existed. Severe mechanical action may also remove metal directly from the surface.

Oxygen Concentration Important

Oxygen can at the same time[3] act to stimulate and to inhibit corrosion. It serves as a strong cathodic depolarizer thereby increasing corrosion. It inhibits corrosion when it improves the stability of the protective films. In many cases,[1] the rate of corrosion is almost directly proportional to the concentration of dissolved oxygen in water.

At low and medium oxygen concentrations, corrosion rates usually increase. As oxygen concentration increases and protective films form, the probability of corrosion decreases. However, the problem may become more severe[3] when this occurs because smaller and smaller areas on the surface remain anodic and the corrosion in these areas proceeds at a much faster rate. This can lead to pitting and rapid penetration of the metal.

At low values of pH — acidic solutions — the effects of oxygen are often pronounced because the films formed on most metals are less stable in acid solutions. For this reason, inhibitors when used for water systems are adjusted for pH in the neutral or slightly alkaline range. Recent studies have shown[4] that corrosion of mild steel in an oxygen and sodium chloride environment can be controlled by higher pH systems. However, the greater the oxygen concentration, the higher the pH required to provide controlled protection.

Other Factors to Consider

The composition of the electrolyte also affects corrosion and must be considered. Gases which form acids in aqueous solutions may produce unstable film conditions as noted earlier. Carbon dioxide, for example, in steam condensate lines tends to accelerate corrosion, particularly when oxygen is present. Salts may increase or decrease corrosion through their effect on the film or scale formed. Some scales may protect the metal surface, while others may both increase and localize the attack.

It is evident from the foregoing discussion that many interrelated factors contribute to corrosion and most often they do not act independently. While a much more detailed discussion of the effects of these various factors may be required to solve a specific problem, what has been said provides sufficient information to consider the various ways in which corrosion proceeds and the ways in which it can be controlled.

What Are the Modes of Attack?

A review of the literature reveals a relatively long list of ways in which corrosion attacks metals. Many, however, are similar when the processes involved are considered and differences are mainly the vernacular of the particular industry in which it is observed. Among the basic forms of attack[1,5,6,7,8] are the following:

Uniform Corrosion

As the name applies, this type of attack proceeds at a uniform rate over the entire structure. It is the most common type of corrosion encountered in acid environments and the easiest to predict and control. When the corrosion rate is known, sufficient metal can be provided in design to give the desired service life. However, this design approach results in increased investment costs which should be balanced against the cost of suitable control measures that might reduce the overall cost. When uniform corrosion rates are high, selection of a more resistant material or isolation of the base construction material from the aggressive electrolyte by means of a resistant coating would be in order.

Galvanic Corrosion

This type of attack is nothing more than a special form of electrochemical corrosion in which the corrosion cell is formed by physical contact of dissimilar metals in an electrolyte. The metals need not be iron and copper, for example, they could be of the same composition (different areas of the same surface) having different heat treatments or mechanical working. The factors previously discussed in the section on the mechanism of corrosion apply directly to galvanic corrosion.

Control of galvanic corrosion can be achieved by selection of materials having a minimum difference in solution pressure as indicated by the Electromotive Force Series, by coating, cathodic protection, and by the use of dielectric couplings. It can be controlled by the use of inhibitors which increase polarization of the galvanic cell.

Intergranular Corrosion

This is a special form of galvanic corrosion in which the grain boundaries of the metal are anodic to the central portion of the grain. Intergranular corrosion is non-uniform and may be confined entirely to the grain boundaries. The difference in potential between the grain boundaries may be due to differences in composition of this metal and the grain, or due to the properties of the electrolyte, which may form a protective film everywhere but at the grain boundaries. Penetration of the grain boundaries may occur rapidly without other evidence of corrosion occurring.

Unstabilized stainless steels are subject to intergranular corrosion if they have been heated to a temperature of 850 to 1650 F for some time. This can occur during welding of the system, for example. Chromium rich carbides are precipitated at the grain boundaries and adjacent areas are depleted of chromium. These areas become anodic to the grain interior and galvanic corrosion occurs. Control of intergranular corrosion may involve simple heat treatment or, in some cases, complex metallurgical design. In the case of austenitic stainless steels, it can be avoided[7] by using stabilized grades of stainless steel in which other alloying elements such as titanium, columbium and tantalum are added to prevent chromium carbide precipitation, use of low carbon types of stainless steel, and by proper annealing treatments.

Pitting Corrosion

This is a non-uniform type of corrosion due to local cell action which can be caused by a number of things, among them[1] deposition of particles which may be flakes of solid or gas bubbles, and formation of an incomplete protective film. Since corrosion is localized, rapid failure by pit penetration may occur even in mildly aggressive electrolytes. Small anodic areas may be established, for example, due to oxygen deficiency in an area under a deposit. Pitting corrosion is frequently found[10] in hot water heating systems and is caused by the presence of dissolved oxygen.

Ten kinds of corrosive attack of metals to look for

- **Uniform corrosion**
- **Galvanic corrosion**
- **Intergranular corrosion**
- **Pitting corrosion**
- **Concentration cell corrosion**
- **Erosion-corrosion**
- **Stress corrosion**
- **Corrosion-fatigue**
- **Dezincification**
- **Hydrogen stress cracking**

Chloride ions are associated[6] with pitting corrosion of steel because of their ability to penetrate corrosion films which would otherwise afford protection. Corrosion can only continue at the local anode of a pit if there is a conductive path through the electrolyte-corrosion product membrane formed over the pit. Chloride ions assure continuing conductivity of the corrosion envelope.

Concentration Cell Corrosion

This type of corrosion is essentially "galvanic" corrosion but differences in potential in this case arise from dissimilar electrolytes in contact with the metal. Differences in pH, metal ion or anion concentration, and in oxygen concentration may produce the concentration cells. The anodic and cathodic areas may be separated by either large or small distances. Each pit in pitting corrosion represents a concentration cell with the anode and cathode in close proximity. Corrosion of underground piping in contact with soils of different compositions is also a form of concentration cell corrosion in which the anodes and cathodes can be separated by considerable distances. Crevice corrosion is still another form of concentration cell corrosion which arises when the crevice is in contact with the electrolyte but is shielded from atmospheric oxygen.

Control of concentration cell corrosion can be accomplished through the use of coatings, cathodic protection, and corrosion inhibitors depending upon the nature of the particular electrolyte.

Erosion-Corrosion

This is a form of attack combining the effects of erosion and corrosion. Corrosion products or protective films formed on the metal surface are removed by erosion in this mode of attack leaving the metal exposed to corrosive attack. Erosion may be caused by abrasive material carried in the electrolyte, by a rubbing together of the corroding surfaces, or through the action of entrained gases (cavitation). In some cases, metal may actually be removed from the surface. This type of attack (sometimes called impingement corrosion) is most frequently encountered at tube inlets, and in valves and elbows where flow conditions are conducive to release of entrained gases and high velocities often occur.

The rate of corrosion depends upon the severity of erosion and corrosion attack. Most metals suffer a high initial rate of corrosion until a protective film is formed on the surface. Thus, in erosion-corrosion this high rate of corrosion will persist if the film is constantly removed by erosion, and rapid penetration and failure can result.

Control of erosion-corrosion can be effected by controlling the velocity within acceptable limits, by providing extra metal at critical areas, by use of sacrificial non-metallic coatings which can easily be replaced, or by the selection of metals which have high unfilmed initial corrosion resistance.

Stress Corrosion

Stress corrosion results from the combined effects of static stress — either internally available or externally applied — and corrosion. This type of attack is exhibited as cracking of the surface and the cracking will continue to progress[11] as long as the stress is applied and the aggressive environment is present. Service life will be long if either of these factors is removed after a certain amount of exposure. Stress corrosion cracking of austenitic stainless steels occurs[7] in acid chloride environments at relatively low stress levels. Stress corrosion cracking of copper and its alloys is associated[1] with environments containing ammonia and related compounds which may develop from decomposition of organic materials.

Control of stress corrosion cracking can be effected by controlling the stress level, or by alteration of the corrodent. The latter is practical only in certain instances, for example, the concentrations of oxygen and chloride in boiler waters flowing through stainless steel piping systems can be reduced, but there is difficulty in avoiding the possibility of evaporation and concentration of the solution at local areas. Thus, the usual approach to solving stress corrosion problems is through control of the stress. This can be done by stress relief annealing to reduce residual stresses, by shot-peening critical locations where there are residual tensile stresses, and by limiting the service stresses in design. Use of materials which stand up to the environmental conditions should also be considered.

Corrosion-fatigue

Similar in nature to stress corrosion, this type of attack requires both stress and corrosion. However, in this case the stress is a cyclical stress, perhaps caused by vibration of a tube in a heat exchanger, which is superimposed upon a corroding metal system. The combined effect of cyclical stresses and corrosion is generally more destructive than either one alone.

Frequent stress reversals disturb the protective film thereby promoting localized corrosion. Eliminating the cause of the cyclical stress by means of vibration eliminators, or redesign to eliminate stress concentration will control this form of corrosion.

Dezincification

The removal of zinc from its alloy with copper is termed dezincification. The mechanism by which it occurs is not clear,[6] but it appears that both the copper and zinc go into solution in the presence of an electrolyte. The copper is redeposited on the surface either as a porous layer or as a plug while the zinc remains in solution. The plug type is the more serious type of dezincification. This form of corrosion occurs most frequently in condenser tubes when exposed to water services and it has also been observed in HTHW systems where pH normally is high.

Dezincification occurs[8] in brasses containing more than 15 percent zinc and reduced zinc content is one method of controlling it. Control can also be achieved by the addition of alloying agents such as antimony, arsenic, or phosphorus. Reducing the aggressiveness of the electrolyte will also control dezincification.

Similar varieties of corrosion in which one component of an alloy is apparently removed by a corrodant include graphitization of cast iron and de-aluminization of certain aluminum bronzes.

Hydrogen Stress Cracking

Failure in this form of attack occurs not through loss of material, but rather through absorption by the cathodes of hydrogen formed by the corrosion process. The failure of steel in such cases occurs because of hydrogen embrittlement. Sulfide stress corrosion of steel is an example of this type of attack. Because hydrogen is generated when cathodic protection is used in a sulfide environment, this form of control will not prevent such cracking. Control is usually effected by proper choice of steel and heat treatment for minimum susceptibility, or by maintaining tensile stresses below critical levels.

How to Control Corrosion

Satisfactory performance of piping materials depends to a great extent on design, installation, and operation of the piping system. Even well chosen materials can fail if consideration is not given to corrosion in all of these stages. It is often possible to prevent or avoid excessive attack if some of the basic corrosion principles outlined earlier are applied.

Methods of controlling the various types of corrosion have been briefly described in the preceding section. These methods are considered in more detail herein with some additional experienced based suggestions to prevent or minimize corrosion of piping systems.

Materials May Provide Answer

Selection of the right material for a particular service must consider the environment in which the material is to function, economics, and experience relating materials to specific services. Alloying has been a primary method of controlling corrosion. While alloying to obtain certain properties is a metallurgical design problem, many alloys have been developed to resist attack in a specific environment.

The use of alloying as a control device has been mentioned in the previous section. Some examples given therein include: selection of brasses with low zinc contents or use of inhibited brasses when dezincification is a problem, and stabilization of austenitic stainless steels to prevent intergranular corrosion. Stainless steel itself was developed when it was discovered that chromium and nickel would strengthen the protective films thereby imparting to steel piping excellent corrosion resistance in a wide range of aggressive electrolytes.

While corrosion resistance is a primary consideration in the selection of an alloy, mechanical properties relating to fabrication, heat treatment, etc., must also be considered and the final choice of material may be a compromise of these many factors. Economics, too, taking into account all of the costs which may properly be charged to corrosion must be considered. In mildly aggressive electrolytes, the use of completely corrosion resistant alloys may not be justified economically if other control methods permit the use of less expensive material at lower overall cost.

In some cases, substitution of non-metallic piping materials may prove necessary or desirable. As was noted in the HPAC Engineering Data File, *What You Should Know About Thermoplastic Piping Systems,* the corrosion resistance of plastic piping materials tends to complement that of the metallic ones. One limitation which prevents wider use of plastics is their relatively low tolerance to temperature and pressure as compared to metallic materials. While this presents no problem in many cases, it does establish rather specific limits of application which must be considered. In some cases, where strength is a limiting factor, the thermoplastics have been used effectively as a liner for steel piping. This provides adequate strength while retaining the corrosion resistance of the plastic. Other non-metallics in addition to the thermoplastics which are employed include, in part, the glass fiber reinforced thermosetting plastics[13] which have greater strength, glass, and rubber.

Cathodic Protection

Cathodic protection can be described in a number of ways. Perhaps the simplest is to consider the electrochemical corrosion process. Anything which can be done to reduce the current flow will reduce the rate of corrosion. The process of impressing a current flow which is of the same or slightly greater magnitude but opposed to the current flowing from the anode to the cathode through the electrolyte in the corrosion cell is cathodic protection. When the proper current is achieved, the current flows from the electrolyte to the structure which then becomes cathodic to the electrolyte.

One of the principal applications of cathodic protection is for control of external corrosion on underground piping systems. However, it can be used in any system[15] in which the metal is in continuous contact with the electrolyte, although the geometry of the system sometimes makes it impractical, as with pipe interiors. Both bare and coated equipment are protected by this method. In the case of coated equipment, the cost of cathodic protection is small compared to the cost of coating, and the protection enhanced so appreciably, that the use of the two together should be considered.[15]

Soil resistivity can be used qualitatively as an indication of the need for cathodic protection for underground piping systems. Corrosion engineers, [15,16] consider protection necessary when soil resistivity measurements along the pipe line right-of-way are in the range of 1000 to 3000 ohm-centimeters. Since as was noted earlier differing concentrations of electrolyte can cause concentration cell corrosion, problems may be encountered at the interface of soils with higher but widely differing resistivities.

Corrosion of the external surfaces of embedded ferrous piping in radiant heating and snow melting systems may be controlled by this method. Application of cathodic protection, it should be noted, is a mixture of both art and science. Where its use is indicated, the services of a specialist in this field should be sought.

Coating for Control

Metallic, inorganic, and organic coatings are employed to control corrosion. Successful coatings form a barrier over the surface which prevents the flow of the electrochemical current or present a more resistant surface to the corrodent. Continuity of the coating is fundamental to the success of the coating in most cases.

The zinc coating on galvanized steel is a familiar metallic coating. Since zinc is anodic to steel, it will cathodically protect small areas of steel which may be exposed. Other metallic coatings include aluminum, copper, nickel, chrome, etc. Metallic coatings are applied by electro deposition, spraying, hot dipping, hot rolling and welding. When the coating is cathodic to the base metal, any holidays which develop in the coating can form a galvanic cell which will corrode rapidly.

Glass and vitreous enamels are examples of inorganic coatings. These are used frequently in the chemical process industries. Films formed by corrosion are also inorganic coatings which can provide protection to the surface as was noted earlier. Such films may be formed prior to starting up a system by pretreatment of the surface with chemicals forming stable films.

Organic coatings include paint, asphalt, the vinyls, epoxy, chlorinated rubber, and polyurethane. Many organic coatings have been available for a relatively short time and experience is limited. These coatings in many cases can be applied in the field whereas the metallic and inorganic coatings must usually be applied by the manufacturer. Successful use of such coatings depends to a great extent upon application and such procedures as are recommended by the manufacturer should be followed.

Alter Environment to Cut Corrosion

Corrosion often can be controlled by modifying the environment in which the structure must operate. Modifications may be either chemical, physical or both. Here are some modifications which can be helpful.

- *Water Treatment* — Water treatment in systems employing water as a heat transfer medium is a good example of alteration of the environment. Many corrosion problems in water piping circuits can be effectively inhibited by proper water treatment. In recent articles, water treatment for closed hot water heating systems,[10] comfort cooling systems,[18] and steam condensate return lines,[19] have been discussed in detail. Water treatment functions to control corrosion through the formation of protective films, adjustment of pH to maintain film stability, and in some cases, such as in the use of hydrazine or other oxygen scavenging chemicals in boiler feed waters to eliminate dissolved oxygen. The control of slime and algae growths to prevent formation of concentration cells beneath masses of them which collect in open recirculating water systems, is another form of corrosion control achieved through water treatment.
- *Control Fluid Velocities* — Since corrosion rates generally tend to increase with velocity due to removal of protective films, velocities should be controlled so as not to exceed acceptable values for the material used. Allowable velocity depends upon the nature of the electrolyte or product being piped, and the corrosion resistance of the piping material. For example, Obrecht[20] has recommended that for copper and copper alloys in less aggressive potable waters that velocities not exceed 8 fps and that temperature not exceed 150 F. For more aggressive waters, he recommends velocities no greater than 4 fps.
- *Eliminate Cavitation* — When handling fluids at or near their saturation pressures, consideration must be given to providing adequate NPSH at the pump to prevent cavitation. Additionally, abrupt changes in direction and abrupt expansions should be avoided in the piping system, if possible, to prevent cavitation attack at such points in the system.
- *Eliminate Crevices* — Concentration cell corrosion can occur at crevices in various types of welded joints, flanged joints, etc. It can be avoided by assuring complete weld metal penetration into the joints, and by careful fitting and selection of gaskets in flanged joints.
- *Stop Electrolyte Access* — Although there are few processes in which the electrolyte can be removed from the corrosion cell, at least one important one comes to mind. This is the external corrosion of piping embedded in concrete in either radiant heating or snow melting systems. If the piping is properly installed, external corrosion does not usually take place. However, failure to consider the movement of surface and/or ground water to the piping can lead to corrosion. The use of suitable vapor barriers between slab and gravel fill, and properly tamped and vibrated dense concrete will help prevent access of the electrolyte to the embedded piping. Many reported failures of these systems can be traced to improper protection against the entry of water. To assure satisfactory performance, the piping should be encased in not less than 2 inches of concrete and should be mounted on non-absorbing metal, stone, or concrete supports. This will insure complete encasement of the piping, and eliminate paths of low resistance to water flow through which water could rise to the piping system.
- *Control Galvanic Cells* — When dissimilar metals must be employed in the same circuit, a number of ways exist to make the resulting corrosion tolerable. When ever possible, the anode

should be made large in area with respect to the cathode. When this is done, the corrosion of the anode will tend to be spread over a larger area and the intensity of the attack will be reduced. Galvanic corrosion can be controlled by coating the cathodic metal, or by coating both the anode and the cathode. Coatings should never be applied only to the anode since any small breaks in the coating may create intense localized attack. Coatings applied to the cathode should resist attack by the alkaline products of the cathode reaction.

A sacrificial spool of the anodic metal in the galvanic couple which can easily be removed for replacement will help minimize the losses when contact of dissimilar metals is required. Attack usually occurs on the anodic surface near the coupled material so relatively short lengths are required.

Water treatment can also be used to control galvanic corrosion. The design of the chemical treatment for poly-metallic systems is complex and requires the services of one experienced in such work.

- *Control by Preventive Maintenance* — Much can be done to forestall corrosion in many systems through proper preventive maintenance. This is particularly true in heating and air conditioning systems where the waters are often mildly aggressive. Cleaning of systems prior to start up to remove mill scale and debris can eliminate potential concentration cells. Cleaning of cooling towers taking in city air laden with particulate matter will minimize tower corrosion by permitting inhibitors to reach the surfaces they are designed to protect. As is often the case, an otherwise well designed system can fail rapidly if attention is not given to maintenance.

Experience Is Important Guide

As indicated herein, corrosion is a complex process involving a large number of variables often acting simultaneously. Sufficient information has been provided in this report to assist in recognizing the various forms of corrosive attack and to suggest ways to control them. Experience is often required in arriving at a solution to a specific problem and the services of qualified persons should be sought out in such cases.

References

1) Obrecht, M. F., and Quill, L. L., *What Is Corrosion*, Heating, Piping & Air Conditioning, Vol. 32, No. 3, p. 109 (March 1960).

2) Copson, H. R., *Effects of Velocity on Corrosion*, Corrosion, Vol. 16, No. 1, p. 130 (January 1960).

3) Akimov, G. V., *Factors Influencing Corrosion, Ibid*, Vol. 15, No. 9, p. 23 (September 1959).

4) Riggs, O. L., et al., *Effect of pH on Oxygen Corrosion at Elevated Pressures, Ibid*, Vol. 16, No. 6, p. 94 (June 1960).

5) Fontana, M. G., *Corrosion and Its Manifestations*, Chemical Engineering Progress, Vol. 53, No. 11, p. 525 (1957).

6) Bruckner, W. H., *Corrosion Control Lecture*, Proceedings, Fourth Biennial Short Course on Corrosion Control, University of Illinois (December 1959).

7) Wicker, A. C., *Why Stainless Steel Is Used For Process Piping*, Heating, Piping & Air Conditioning, Vol. 32; No. 4, p. 120 (April 1960), & No. 5, p. 127 (May 1960).

8) Nelson, G. A., *Prime Reasons for Metal Failure*, Chemical Engineering, p. 132 (June 29, 1959).

9) Jelinek, R. V., *Corrosion: Refresher Course on Cause and Cure, Ibid*, p. 114 (July 28, 1958).

10) Hayman, R. H., *Good Procedures Forestall Corrosion in Hot Water Heating Systems*, Heating, Piping & Air Conditioning, Vol. 33, No. 3, p. 115 (March 1961).

11) Metzger, M., *Factors in Stress Corrosion Cracking and Its Control*, Proceedings, Fourth Biennial Short Course on Corrosion Control, University of Illinois (December 1959).

12) *What You Should Know About Thermoplastic Piping Systems*, Heating, Piping & Air Conditioning, HPAC Engineering Data File, Vol. 33, No. 3, p. 127 (March 1961).

13) Levy, R. M., *What You Should Know About Glass Reinforced Plastic Piping, Ibid*, Vol. 33, No. 1, p. 182 (January 1961).

14) Bruckner, W. H., *Principles of Cathodic and Anodic Protection*, Proceedings, Fourth Biennial Short Course on Corrosion Control, University of Illinois (December 1959).

15) Parker, M. E., *Cathodic Protection Practices, Ibid.*

16) Dean, R. O., *Application of Electrical Measurements in Corrosion, Ibid.*

17) *Glass Linings and Vitreous Enamels*, Corrosion, Vol. 16, No. 12, p. 107 (December 1960).

18) Sussman, S., and Portnoy, I. L., *How and Why Corrosion Occurs in Air Conditioning Water Circuits*, Heating, Piping & Air Conditioning, Vol. 33, No. 6, p. 134 (June 1961).

19) Obrecht, M. F., *Filming Amine Inhibitors Control Corrosion, Improve Heat Transfer in Steam Heating Systems, Ibid*, Vol. 31, No. 11, p. 121 (November 1959).

20) Obrecht, M. F., and Quill, L. L., *How Temperature, Velocity of Potable Water Affect Corrosion of Copper and its Alloys, Ibid*, Vol. 33, No. 4, p. 129 (April 1961).

21) Wachter, A., *Proper Design Voids Equipment Corrosion*, Chemical Engineering, p. 162 (February 22, 1960).

California Rink Built with STEEL PIPE

Glacier Falls Ice Rink, in Anaheim, California, is another example of the nation-wide boom in skating. It's a fast-growing trend that's slicing a big share of the recreation business for the new ice rinks now being built in unprecedented numbers. And more and more of them are being built with steel pipe, such as Bethlehem Ammonoduct.

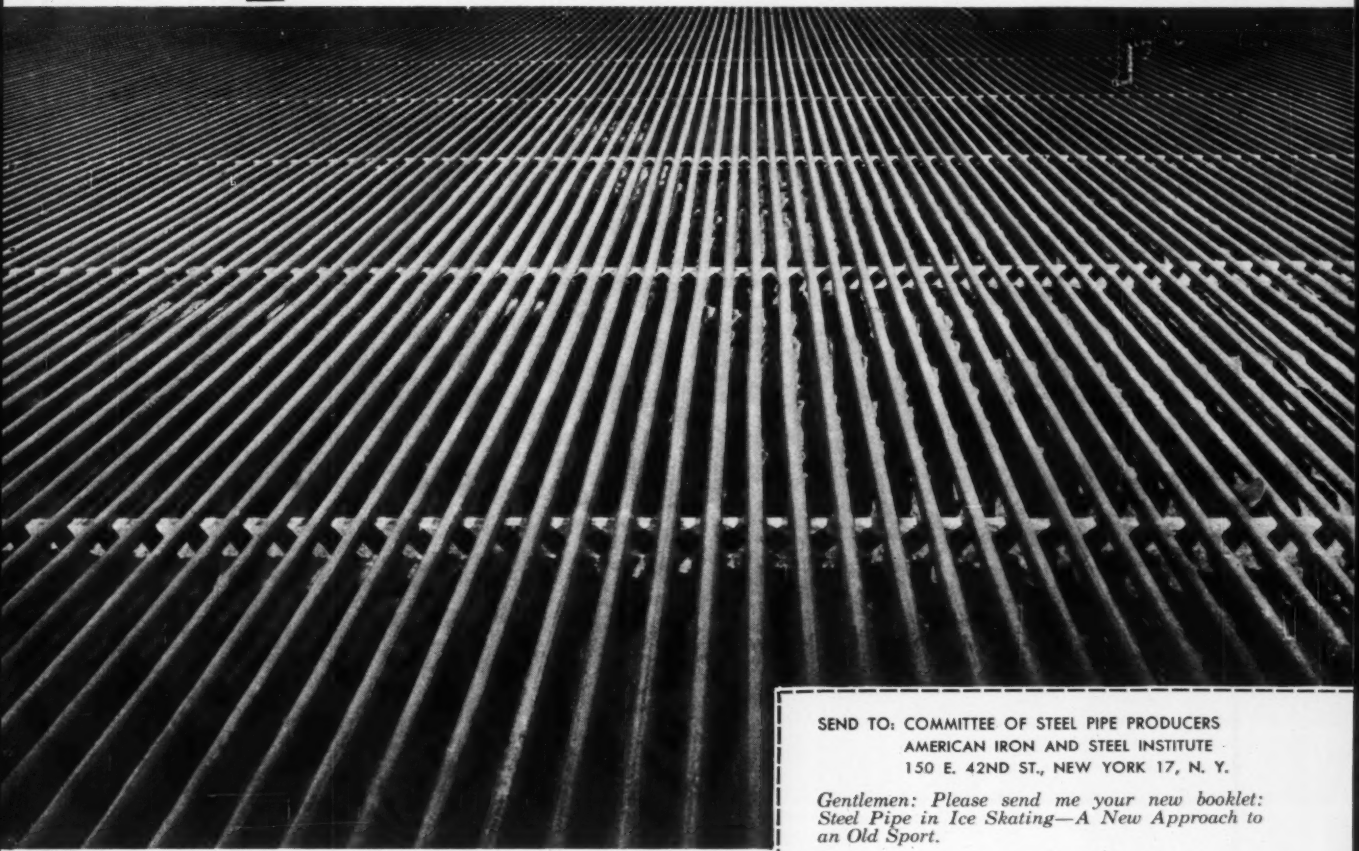
WHY STEEL PIPE? Steel pipe *costs less* than any other ferrous piping material. And it's *less costly to install*. It can be *bent cold* without danger of fracture, and is available in *double-random lengths*, cutting down on field welds. The coupon below will bring you the full story.

Pipe your next rink with steel—steel pipe Made in U.S.A.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



Steel

for strength
... economy
... versatility

Glacier Falls Ice Arena, Inc., built this 85 by 180-ft rink with Bethlehem's Ammonoduct steel pipe. Refrigeration was designed by William Webster, and contracted to George Baney. Kohlenberger Engineering Corporation engineered the rink, with the pipe supplied in 40-ft lengths by Monarch Piping and Engineering Company. Marshall Garrett manages the rink, with his assistant, Willie Kall.

SEND TO: COMMITTEE OF STEEL PIPE PRODUCERS
AMERICAN IRON AND STEEL INSTITUTE
150 E. 42ND ST., NEW YORK 17, N. Y.

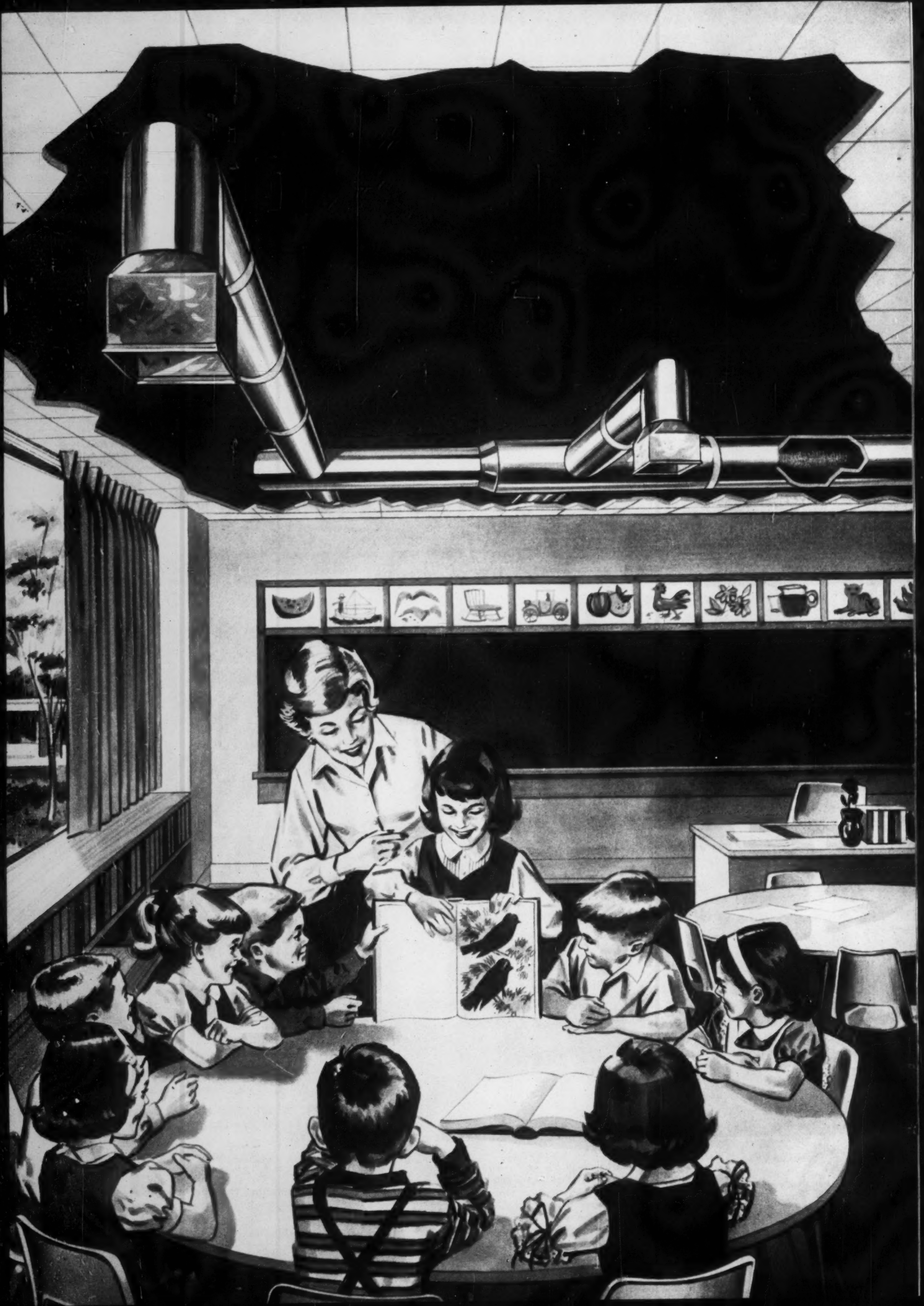
Gentlemen: Please send me your new booklet: Steel Pipe in Ice Skating—A New Approach to an Old Sport.

Name ________________

Company ________________

Address ________________

City ________ *Zone* ____ *State* ________



Maximum Fire Protection With Aluminum Encased G-B Duct

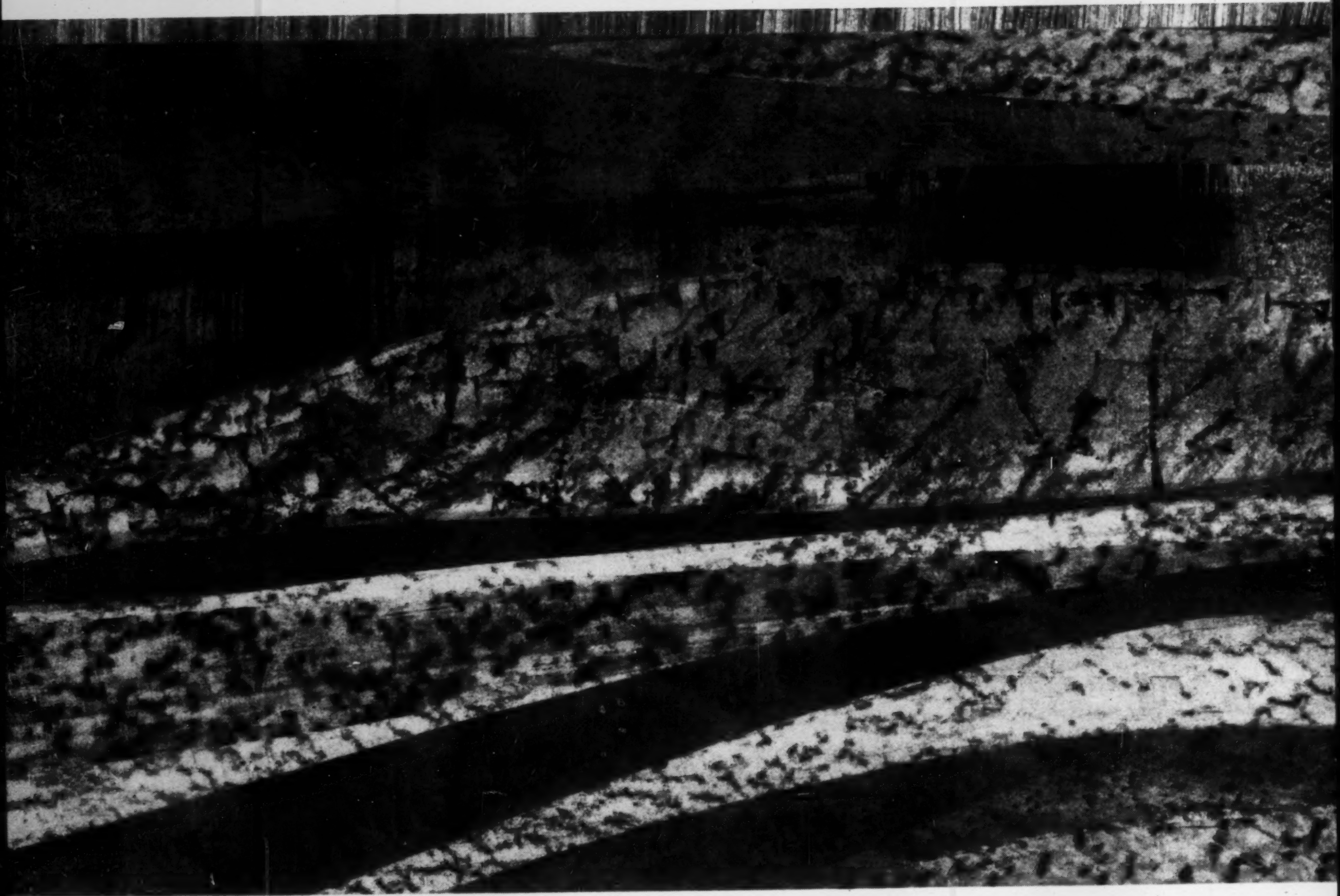
For the first time there's a prefabricated air duct that meets the strictest fire codes for commercial heating and air conditioning. It's G-B Duct, the round, prefabricated air duct made entirely of high-density fiber glass insulation. Enclosed in a heavy-duty, welded aluminum casing, G-B Duct is rated incombustible and meets the requirements of the NBFU Bulletins 90 A and B for commercial and residential duct systems. In addition, it is the one air duct that: *gives higher thermal efficiency than that of conventional duct wraps and liners* ● *reduces noise as effectively as 1½" thick duct liner* ● *cuts installation cost as much as 50% . . . each 6' section combines thermal insulation, sound absorber, and vapor barrier in one lightweight, ready-to-use air duct* ● *provides essentially the same air friction coefficient as bare sheet metal.* It will pay you to thoroughly investigate G-B Duct. Write for detailed information today.

In schools, motels, clinics, hospitals, or wherever fire ratings are important, aluminum encased G-B Duct meets the strictest fire codes for commercial heating and air conditioning.

gb®
GUSTIN-BACON
Manufacturing Company

220 West 10th St., Kansas City, Mo.

With FOAMGLAS® Insulation, underground piping is



out of sight, out of mind

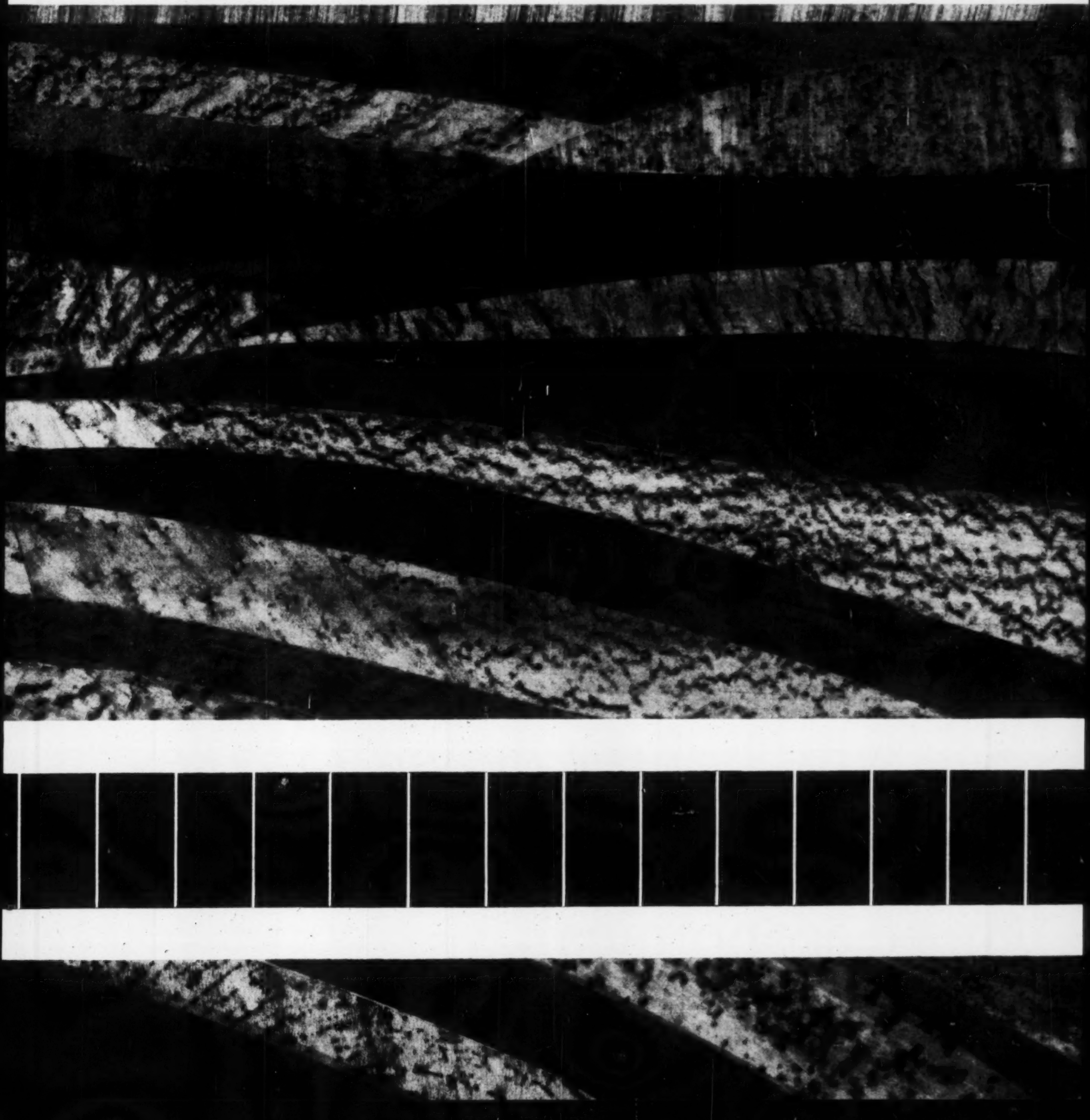
Direct burial of insulated underground piping eliminates unsightly above-ground lines . . . and it can be done practically and economically with FOAMGLAS Insulation. Here's why:

The rigid cellular glass composition of FOAMGLAS is impervious to moisture . . . and it can withstand the heavy loadings of soil backfills. FOAMGLAS has a compressive strength of 7 tons per sq. ft. (av. ult.), thus there is no need for expensive tunneling or vault burial. Since it is all glass and completely inorganic, it will not react to soil acids. FOAMGLAS stays dry even under the wettest soil conditions and will protect piping against rust and corrosion. It also retains full insulating efficiency to keep lines operating at design temperatures.

FOAMGLAS has been used to insulate central air conditioning lines of chilled water . . . municipal steam heating system lines . . . and many other hot and cold service lines.

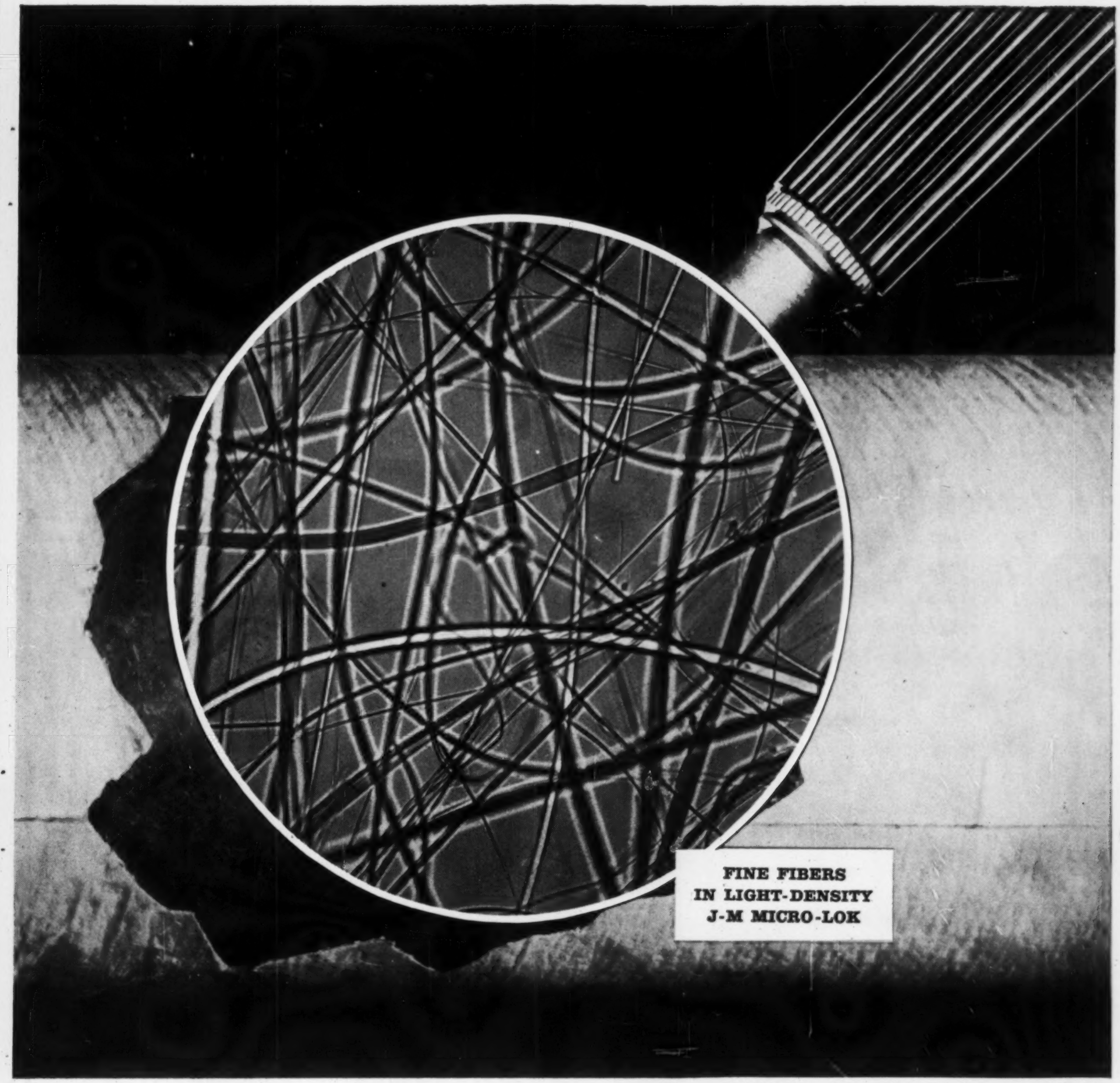
For more information on how FOAMGLAS can keep your piping out of sight . . . out of mind, send for free copies of our Industrial Insulation catalog and underground insulation specifications. Pittsburgh Corning Corporation, Dept. HP-111, One Gateway Center, Pittsburgh 22, Pa. In Canada, 3333 Cavendish Boulevard, Montreal, Quebec.

PITTSBURGH CORNING



THE BIG DIFFERENCE IN PIPE INSULATIONS:
COARSE FIBERS IN HEAVY-DENSITY INSULATION

See why lighter density makes **J-M MICRO-LOK** most effective... most economical



Photomicrographs of glass fibers at 250x magnification

Micro-Lok pipe insulation is made of long, resilient, extremely fine glass fibers. This means that infinitely more and smaller air pockets are created than would be formed by coarse, more rigid fibers made by an old-fashioned process.

Thus, Johns-Manville Micro-Lok provides considerably more resistance to the passage of heat, yet its density is only about half that of pipe insulations made of coarse fibers.

Specifically, fine-fibered, light-density Micro-Lok has a k factor of .245 at 100F mean temperature—about 10% *lower* than coarse-fibered, heavy-density products.

Micro-Lok's superior resiliency also means that its surface can more readily absorb accidental blows without puncturing or ripping the vapor barrier jacket.

Micro-Lok is highly effective for temperatures from minus 120F to 370F. Made in all standard IP and CT sizes and wall thicknesses, Micro-Lok is available with a wide range of factory-applied jackets including canvas, general purpose and flame-resistant vapor barriers such as the new Flame-Bar. For details, write to J. B. Jobe, Vice-President, Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.

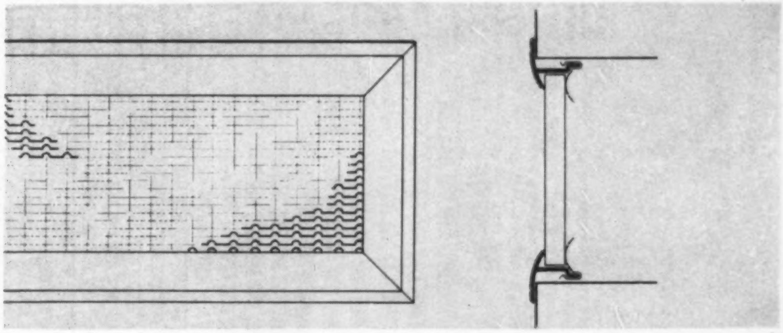
JOHNS-MANVILLE
FIBER GLASS

JOHNS-MANVILLE
JM
PRODUCTS

Making air behave..
Distinctive styling to suit the room

..beautifully!

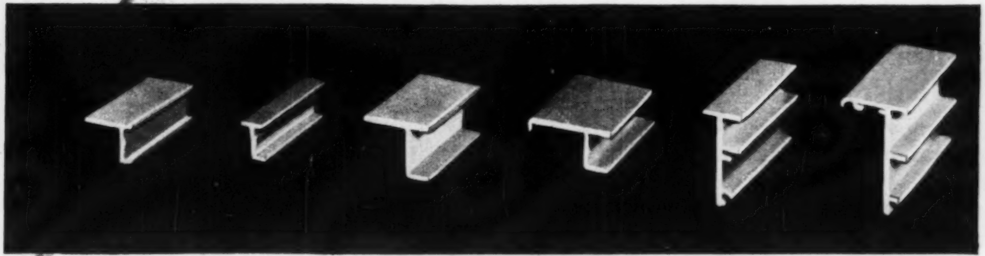
Comfort-proven Uni-Flo sidewall diffusers available in a wide variety of extruded aluminum frames



Now you can combine the air distribution superiority of the Uni-Flo sidewall diffuser with any one of a wide variety of attractive aluminum frame styles—to make air behave *beautifully* in more ways than one. Each extrusion opens a new realm of design opportunities to the architect—yet each possesses the architectural grace to blend inconspicuously into the room decor.

The adjustable Uni-Flo core available with *exclusive* extruded aluminum frame diffusers creates a controlled turbulence that thoroughly diffuses the conditioned air *before* it reaches the occupancy zone. This principle of air diffusion, long proven in the field and in the laboratory, creates Comfort-Chart conditions—completely eliminates drafts commonly associated with "streamlined" diffusers which can drop masses of cold air onto the people in a room.

Uni-Flo diffuser performance is guaranteed. Quiet, unobtrusive sound levels are assured in advance of installation because Barber-Colman provides comprehensive noise level data for every diffuser size and operating condition. For detailed information, call your local Barber-Colman office.



BARBER
COLMAN

BARBER-COLMAN COMPANY

Dept. W, 1101 Rock Street, Rockford, Illinois

. . . where originality works for you

PITTSBURGH HILTON HOTEL, Pittsburgh, Pennsylvania. Architect: Wm. B. Tabler, N.Y.C.; General Contractor: Turner Construction Company, N.Y.C.; Mechanical Engineers: Jaros-Baum-Bolles, N.Y.C.; Plumbing Contractor: Sauer, Inc., Pittsburgh.

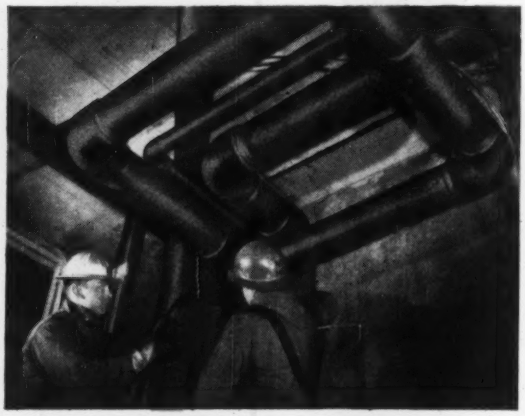
130,000 lbs. of water lines!

Anaconda copper tube up to 8″ throughout

There are many reasons why Anaconda Copper Tube is so often the choice for modern water supply and drainage systems. It is, for example, extremely easy to handle in limited work spaces. This, of course, helps keep initial costs low. Add such advantages as long life and trouble-free maintenance and you have a material mighty hard to beat.

For complete information about Anaconda Copper Tube and Fittings for general plumbing, heating, air conditioning and refrigeration, write for free copy of Publication B-1, Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 61-1027

ANACONDA®
AMERICAN BRASS COMPANY



In the new Pittsburgh Hilton the hot, cold and chilled water supply is delivered by 130,000 lbs. of Types K and L Anaconda Copper Tube in sizes to 8″.

EQUIPMENT DEVELOPMENTS

Air Handling Units Offered In Capacities to 44,000 Cfm

Units heat or cool the air, remove dirt, humidify or dehumidify, or serve as simple air circulators. Operate with either steam or hot water as a heat source, with a water chiller or a direct expansion coil as a cooling source. Available in 37 horizontal, vertical, and multi-zone type units in 14 sizes ranging in capacity from 600 to 44,000 cfm and providing a nominal outlet velocity of 1600 fpm. Each size casing allows from two to four coil sizes either in left or right hand combinations. Also, six motor positions and four fan discharge positions are available. — *Acme Industries, Inc.,* 600 *N. Mechanic St., Jackson, Mich.*

Ventilation System for Group-Size Fall-Out Shelters

Available for human capacities up to 75 persons, and outside air capacities up to 375 cfm. Filters built to U.S. Atomic Energy and Army Chemical Corps standards are available for each model. — *Buffalo Forge Co.,* 490 *Broadway, Buffalo* 5, *N.Y.*

15 Ton Gas Absorption Chiller Has Two-Effect Generator

Uses water as a refrigerant and lithium bromide as the absorbent. One small pump circulates the solutions in the sealed system. Produces chilled water for industrial cooling operations. Two-effect absorption device can be applied to loads of from 1 to 1000 tons. — *Statham-Swearingen, Inc.,* 12401 *W. Olympic Blvd., Los Angeles* 64, *Calif.*

Gas-Fired Infra-Red Heater Has 40,000 Btu Per Hr Capacity

Rectangular unvented, open flame unit has combustion occur on the enclosed surface of a high-temperature alloy screen. When metal reaches maximum temperature, infra-red rays are radiated downward from its exposed surface. An aluminum reflector concentrates the rays on the area being heated. Units are suspended above the floor. Described in bulletin No. 580-15 — *Dravo Corp., Neville Island, Pittsburgh* 25, *Pa.*

Air Conditioning Controls Allow Dual Operation

Provides dual control for new and existing office building air conditioning systems. Programming clock starts and stops entire system, but triple over-riding control provides restarting of individual zones, followed by periodic shut-down by programming clock. No control wiring required. — *Remington Corp., Air Conditioning Div., Auburn, N.Y.*

INFORMATION on capacities, dimensions, applications, and special features in each item is presented in accordance with material furnished by the manufacturers, who may be contacted directly for more details.

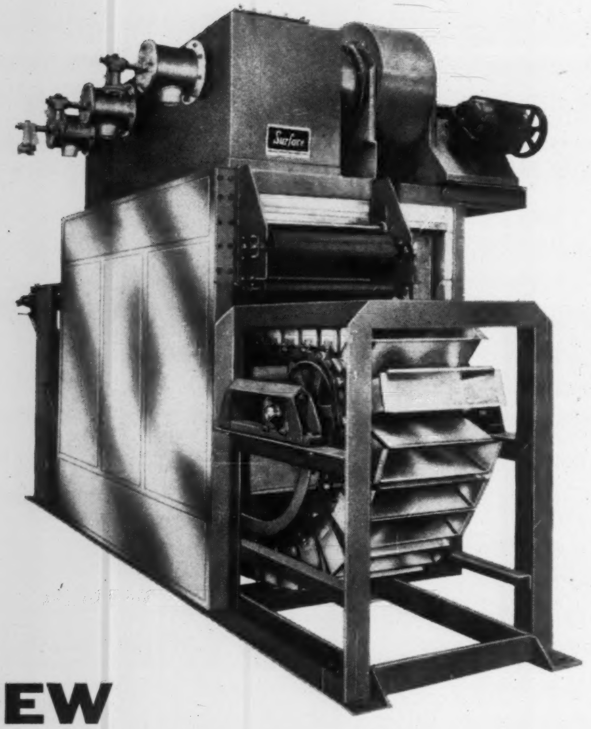
Other Departments . . .

Recent Trade Literature 228

We Hear That 254

Meetings and Conventions. 258

New Books and Reports 262



NEW
continuous automatic drying and toasting

This toasting machine, long in development at Kathabar laboratories, may be precisely the means of putting your drying, puffing, and other high temperature processing operations on a continuous basis. Stainless steel trays convey the material, while in a "fluidized" state, through the oven under precise temperature control. Make use of Kathabar's unique fund of hard-earned experience in continuous automatic control of temperature and humidity to speed the processing of a wide range of foods and chemicals.

KATHABAR®

where the experts turn for help

SURFACE COMBUSTION, 2384 Dorr St., Toledo 1, Ohio
a division of Midland-Ross Corporation

Please send facts on ☐ *drying* ☐ *toasting for following application:*

....

name & title ....

company ....

street ....

city .... *zone* .... *state* ....

EQUIPMENT DEVELOPMENTS

Continued

Ball Valve Features Seats With Four Different Materials

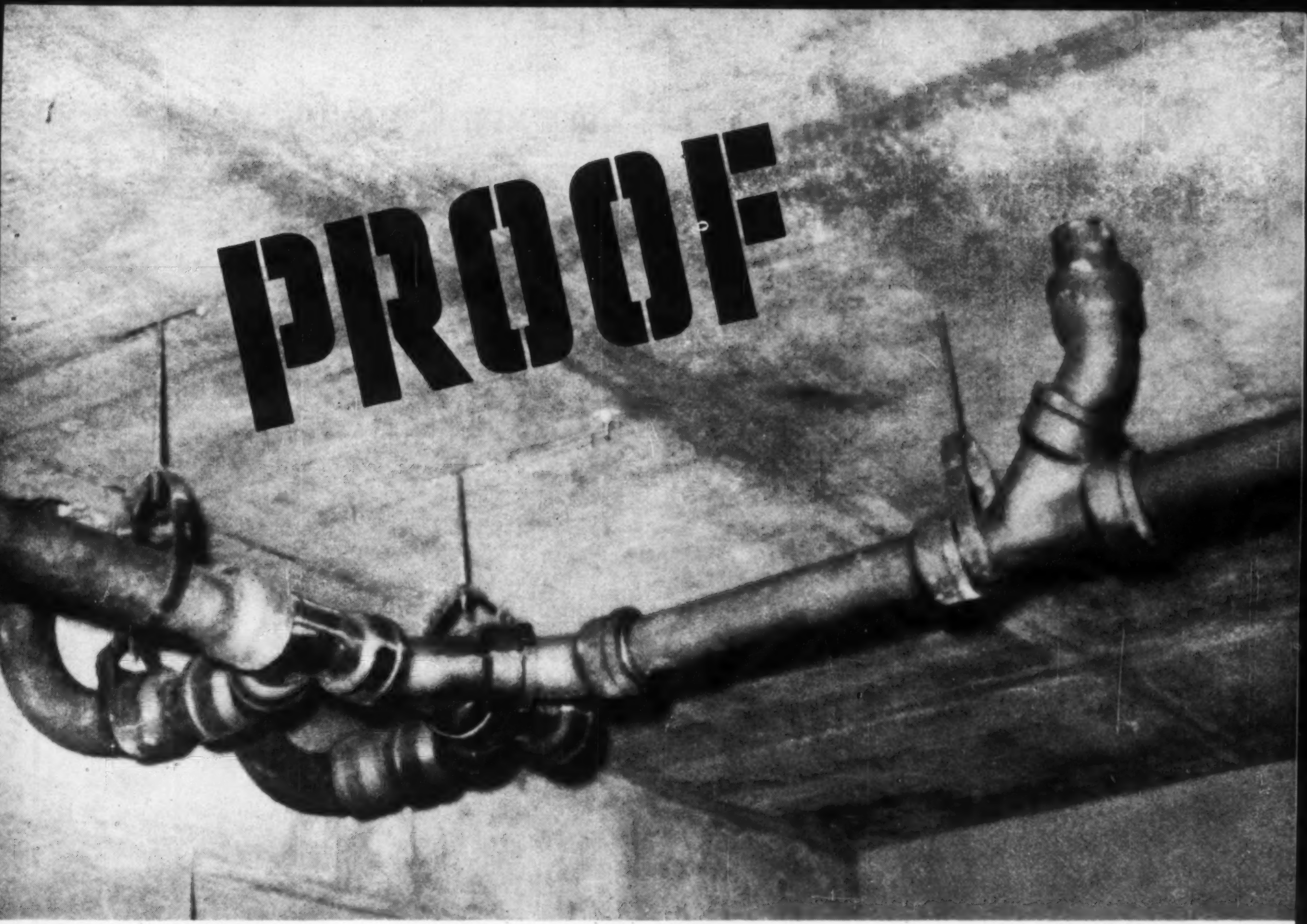
Interchangeable seats in ball valve available in "Teflon," "Neoprene," "Buna-N," and nylon. Nylon seat is rated at 2500 psi for 1/4 through 3/4 in. sizes, and 2000 psi for 1 through 2 in. valves. Effective operational range is −20 to 180 F. Rating is 1000 psi for all sizes using "Teflon" seat, with a temperature range of −450 through 450 F. Temperature range for "Neoprene" is −20 through 200 F; for "Buna-N," −20 to 250 F. Valves available in forged stainless steel, carbon steel, or brass in eight sizes from 1/4 through 2 in. — *Clayton Mark & Co., 1900 Dempster St., Evanston, Ill.*

Globe Valve Offered in Copper to Copper Line

Available in sizes of 3/8 to 2 in. to complete firm's line that includes gate valves available from 3/8 to 4 in., and swing check valves from 3/8 to 2 in. Valves service steam, water, oil, or gas. Can be repacked when wide open under pressure. — *Milwaukee Valve Co., Inc., 2375 S. Burrell St., Milwaukee 7, Wis.*

Copper Shock Suppressor Prevents Water Hammer

Eliminates the noise and damaging effect of pressure building up in a line which is caused by a sudden stoppage of flow when flow is cut-off. Suitable for industrial applications, and for fluids other than water. Pressure is directed into a cylinder-shaped shock absorber where a piston is forced up against a resilient cushion of air. — *Chase Brass & Copper Co., 236 Grand St., Waterbury 20, Conn.*



NO SAG... NO BEND... NO CHANNEL SUPPORT DURIRON MAKES NEAT, STURDY INSTALLATIONS

No excessive continuous supports, braces and hangers are needed to keep Duriron from bending, snaking, or splitting. It's the strongest of all corrosives-handling pipe, simplifying installation . . . assuring long-term, trouble-free service. The proof is in the record!

Unlike substitute non-metallic materials which have a much higher expansion coefficient, a resilient Duriron installation is unaffected by heat. It handles with negligible attack all normally used laboratory wastes . . . acids, alkalis **and solvents** . . . at temperatures up to their boiling points! And Duriron is far more versatile in handling the compound problem of corrosion and temperature. You can hide it behind ceilings, imbed it in walls, bury it underground with normal plumbing procedure. No elaborate precautions needed!

When you plan a corrosives-handling piping installation remember this: Duriron brings you **proof** of 40 years of outstanding service . . . performance on which you can depend.

THE DURIRON COMPANY, INC. • DAYTON 1, OHIO DURCO

A & A's "Bid-Maker"

L-28 ECONOMY FLOOR DIFFUSER

(4" x 14" size shown)

YOU CAN HAVE "ROCK-BOTTOM" ECONOMY with our L-28 "Bid-Maker" FLOOR DIFFUSER . . . the kind of economy today's low-priced housing market demands in order to be competitive.

YOU SAVE ON MATERIAL because the L-28 costs you less than comparable diffusers.

YOU SAVE TIME because no tools are required for installation. Anyone can place the L-28 over the opening and the job is done . . . no screws or nails are necessary.

YOU OFFER QUALITY all down the line with features that are usually found only in floor diffusers priced considerably higher. Features like free-moving dial damper control, adjustable damper opening stop. The fins of the L-28 are constructed on 1/3 inch centers for minimum "see-through", greater safety and a more attractive appearance. The fins are preset at the factory but can be quickly adjusted on the spot to deliver any air-flow pattern desired.

Why pay more . . . Why offer less?

SIZES AVAILABLE	FINISHES AVAILABLE
2¼ x 10	Beige Prime
2¼ x 12	Brown Metallic
2¼ x 14	Brass Plated
4 x 10	Chrome Plated
4 x 12	
4 x 14	

Ask your local jobber about the new Air-Master Series and get your copy of the new full-color A & A Catalog 60 or write direct to:

The A & A Register Company
8337 CLINTON ROAD • CLEVELAND 9, OHIO
ATlantic 1-6166

EQUIPMENT DEVELOPMENTS

Continued

6 In. Scale Thermometer Adjusts to any Angle

Industrial thermometers feature internal tapered lock construction and a set screw adjustment for locking at any desired viewing angle. Available with separable wells for liquid service, or with bare bulbs and perforated stems for greater sensitivity and speed of response. Ranges are from −40 to 500 F. Cases are of cast aluminum. All models have a red reading mercury column and white face with black markings. — *Precision Thermometer and Instrument Co.,* 1434 *Brandywine St., Philadelphia* 30, *Pa.*

Offer Boilers In Low Btu Range

Sixteen models available with a Btu range of 200,000 to 3,000,000. Packaged hot water boilers are gas-fired. Oil-fired units and low pressure steam boilers will be available in the near future. — *Cleaver-Brooks Co.,* 326 *E. Keefe Ave., Milwaukee* 12, *Wis.*

Airfoil Fans Feature 12-Blade Design

Class I and II fans available in wheel diameters of 24 to 89 in. Class III fan wheels range from 24 to 73 in. Blades have a very slight chamber and a thickness that is 12 percent of the blade's chord to increase efficiency. Contour of inlet cone permits air entry with a minimum of shock and turbulence. Wheel rim contour is made to match that of the inlet cone to reduce turbulence in the entering air as it leaves the cone, and also to assure uniform air flow through the wheel. Described in bulletin DS-348. — *The Trane Co., La Crosse, Wis.*

Spring-Loaded Relief Valve Features Diaphragm Actuation

Single-seated relief valve for WOG service up to 300 psi. Body is cast iron with nickel alloy or stainless steel trim. Features renewable valve disc and "O" ring construction. Handles liquids up to 180 F. Relief pressure ranges are: 5 to 55, 20 to 70, 35 to 90, and 100 to 250 psi. Available in six sizes from ½ to 2 in. — *Atlas Valve Co.,* 280 *South St., Newark* 14, *N.J.*

Gives You MORE, Costs You LESS Check all the FEATURES!*

RP®

UL Listed

Multi-Velocity INDUSTRIAL AIR FILTER

FOR HEATING OR AIR CONDITIONING

- ✶ **ALUMINUM** construction...rust-proof...corrosion-resistant. Eliminates need for expensive, heavy structural design in filter bank construction.
- ✶ **EASY TO HANDLE** Light-weight permits carrying, washing and installing of many more filters per hour.
- ✶ **EASY TO CLEAN** Lint and dirt are easily flushed off with water because of water soluble Super Filter Coat (the adhesive with the built-in detergent).
- ✶ **DEPTH LOADING** Designed to minimize surface loading, with depth loading accomplished through successive layers of slit and expanded aluminum, and varying baffle sizes.
- ✶ **REMOVES ODORS** Revolutionary R P Super Filter Coat adhesive adds odor removal to the normal dirt-trapping properties of R P Industrial Air Filters —with no increase in resistance—at *no* extra cost!
- ✶ **GERMICIDAL** Super Filter Coat adhesive contains Hexachlorophene, the well-known bacteria destroying agent.
- ✶ **LOWER RESISTANCE** Unique baffle design permits maximum air passage...more uniform dust collection within the filter depth.
- ✶ **HIGHER EFFICIENCY** Scientifically staggered pattern of flat baffles sets up a controlled turbulence that centrifuges dust and odor particles onto the adhesive for maximum efficiency.

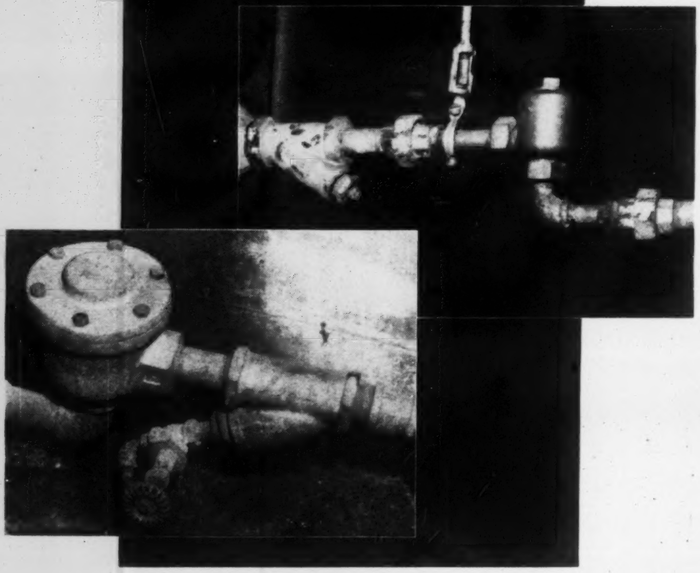
for information, write RP / *Products of Research*

RESEARCH PRODUCTS *Corporation* Dept. 46-K, Madison 1, Wisconsin

AFI MEMBER

Consider These Facts about THERMOSTATIC TRAPS

TO ASSURE HIGH EFFICIENCY AND LOW MAINTENANCE



Every trapping requirement cannot be met with one trap. Consequently Anderson manufactures a complete line of traps including the remarkable Quik-Flex Thermostatic Steam Trap. From one source you can meet all your trapping needs. If you are using or planning to use thermostatic traps, consider these important facts—features built into every Anderson Quik-Flex Trap.

- **Large capacity covering a wide pressure range simplifies specifications.**
- **Only one moving part assures low maintenance and less downtime.**
- **Fast heating up of units through quick discharge of condensate and/or air.**
- **Guaranteed freeze-proof when properly installed and operated for outdoor operation.**
- **Compact design permits simplified piping in hard-to-get-at places.**
- **Immediate delivery is guaranteed from inventory.**

Write FOR COMPLETE INFORMATION AND BULLETIN 257 DESCRIBING THE ANDERSON QUIK-FLEX THERMOSTATIC TRAP.

SUPER SILVERTOPS STEAM TRAPS
BY THE MANUFACTURERS OF Hi-eF PURIFIERS

THE V. D. ANDERSON COMPANY
Division of International Basic Economy Corporation
1949 West 96th Street • Cleveland 2, Ohio

Natural Gas Engine Has 130 Hp Capacity

Particularly suited for air conditioning applications. Features direct conversion from its diesel counterpart. Allows up to 25,000 hr of operation before first overhaul. Also permits taking rated power from the engine on a continuous basis, derating only for altitude and temperature. A naturally aspirated, six cylinder incline engine with a 4.5 in. bore by 5.5 in. stroke, unit develops 130 hp at 2000 rpm. Offered in either a 12:1 or an 8.5:1 compression ratio. — *Caterpillar Tractor Co., Engine Div., Peoria, Ill.*

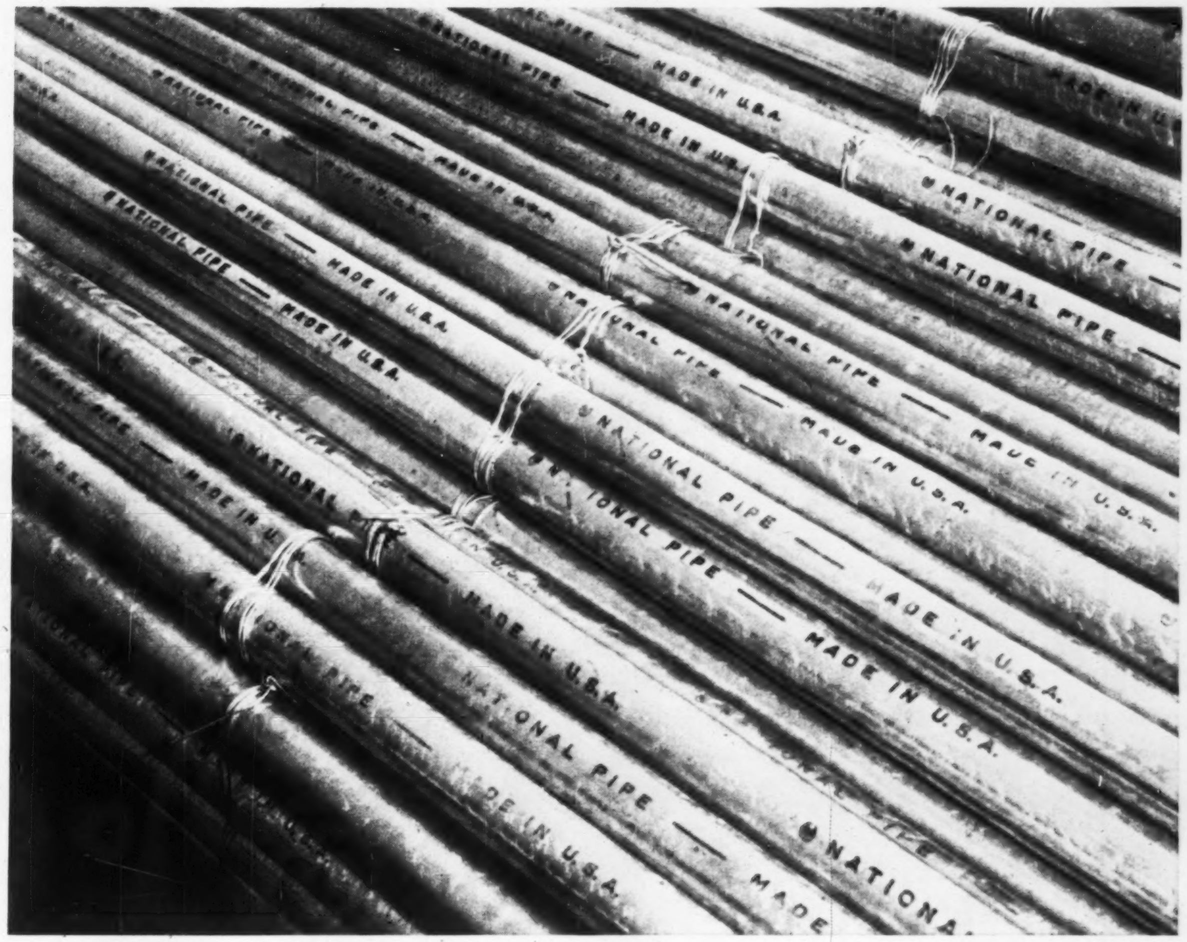
Centrifugal Air Fan Has Direct or V-Belt Drive

Primarily for combustion-system applications. Available in capacities from 100 to 5300 cfm with 3600 rpm motors up to 30 hp. Fan scroll is welded steel. Double-shroud impeller is aluminum alloy. — *Pyronics Inc.*, 17700 *Miles Ave., Cleveland* 28, *Ohio.*

Urethane Pipe Covering for All Insulation Applications

"Hewflex" provides insulation for liquid cooling and heating lines, chilled water lines, and industrial processing lines. Cellular structure gives material a low K value. Unaffected by moisture. Seals out air and vapor, prevents condensation. Applies without special fittings, even around 90 deg turns and over "T" joints. Requires no special tools. Material is ozone resistant, self-extinguishing, essentially odorless, and has a white surface. — *H. E. Werner, Inc.*, 2990 *Industrial Blvd., Bethel Park, Pa.*

This mark tells you a product is made of modern, dependable Steel.



Be sure the pipe you buy is marked "USS National Pipe . . . Made in U.S.A."

Take a good look at the next pipe you buy. Do you know who made it? How it was made? Its quality? If your pipe is marked "USS National Pipe—Made in U.S.A.," you can be sure you're getting high-quality steel pipe made on the most modern facilities by the largest pipe producer in the world. (National Tube led the way with its pipe-marking program.)

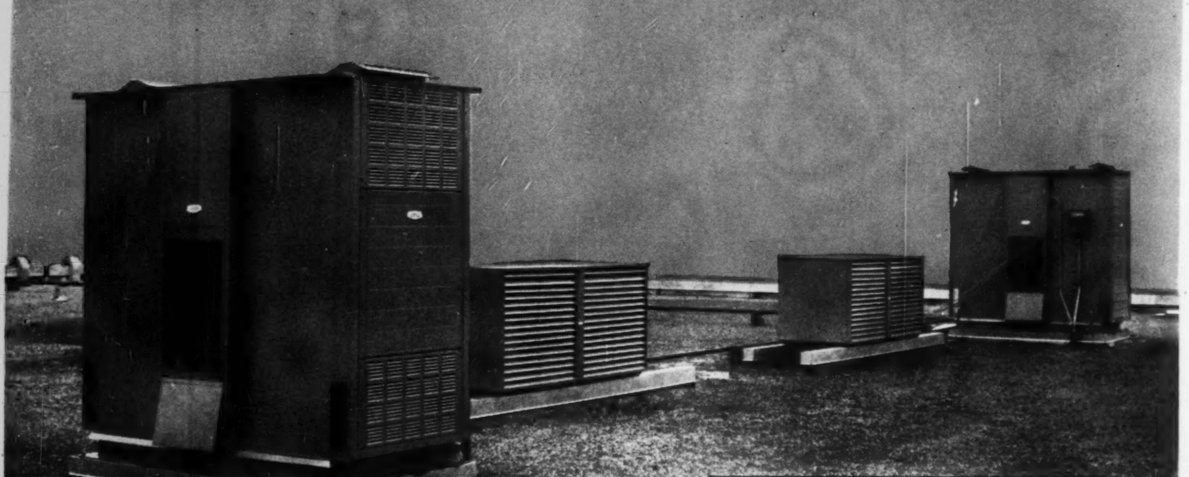
Order USS National Pipe from your local National Tube Distributor. You get fast delivery of the finest product from a man you can trust—a tough combination to beat!

USS and National are registered trademarks

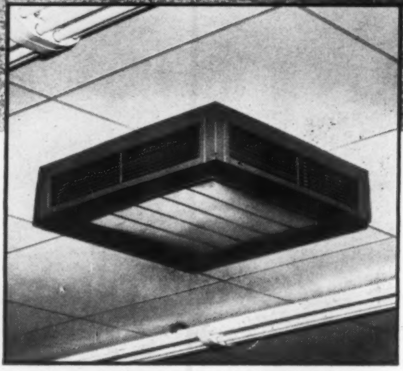
National Tube
Division of
United States Steel

Columbia-Geneva Steel Division,
San Francisco Pacific Coast Distributors

NEW LENNOX ROOF TOP UNIT GIVES YOU UNMATCHED FLEXIBILITY...



Above: Handsome appearance on shopping center roof. Here, a condensing unit serves each roof top unit. One large condensing unit could serve both roof top units.

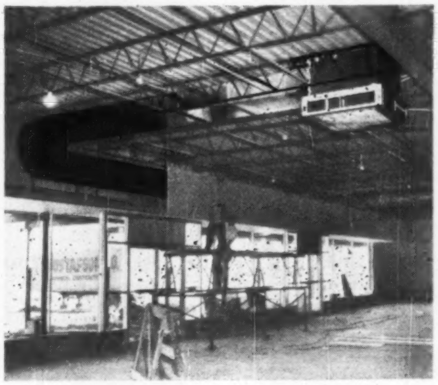


Right: Air outlets are 3½-in. below ceiling to minimize smear. Four way deflection grilles permit complete control of air direction and throw. Return air enters bottom grille. (Flush diffuser is optional.)

- **Spot-cool or heat wherever needed (such as check out areas).**
- **Can use directly connected ceiling diffuser (adjustable) or duct system —or combination of both.**
- **Outdoor air for ventilation and "free" cooling is automatically controlled . . . up to 100%.**
- **Ideal for zoning. One Lennox unit can serve as two independent heating-cooling units.**
- **Cooling capacity: 7½ or 11 tons each.**
- **Gas heating capacity: 102,000 to 340,000 btuh input (increments of 34,000).**

........for HEATING!
COOLING!
VENTILATING!

Now, out of sight, out of mind, out of the high cost sales floor area! This new Lennox Roof Top Unit sits quietly on the roof, providing the year 'round comfort conditions required by your business. Two Lennox Landmark® (modular heating and cooling) units are expertly designed and combined into one package to give you unmatched flexibility in a roof top unit.



Duct carries warm air to "curtain" the doorway. When delivered air is cool, automatic damper diverts it back through diffuser head.

There are over 5,000 factory-trained Lennox Dealers ready to serve you. They are backed up by 200 field engineers and 22 National Account Specialists. Write for complete data offered free in detailed "Roof Top Unit" Kit. Address: Lennox Industries Inc., 801 S. 12th Avenue, Marshalltown, Iowa.

Don't be satisfied with less than

LENNOX

HEATS · COOLS · TREATS AND MOVES AIR

IN HOMES IN CHURCHES IN SCHOOLS IN BUSINESS IN INDUSTRY

LENNOX Industries Inc., est. 1895 — Marshalltown, Ia.; Columbus, O.; Syracuse, N. Y.; Decatur, Ga.; Ft. Worth, Tex.; Salt Lake City, Utah; Los Angeles, Calif.
LENNOX Industries (Canada) Ltd.—Toronto, Montreal, Calgary, Vancouver, Winnipeg.

Hot Water Baseboard Radiation Has Box-Fin Twin-Tube Elements

Rated at 1320 and 1000 Btu per hr per ft at 200 and 180 F water temperature respectively at flow rates of 4 gpm. Cover dimensions are 14½ in. high off the floor and 5½ in. deep from the wall. A U-fitting for manifolding the ends of the parallel tubes is also available. Described in bulletin 607. — *Edwards Engineering Corp., Pompton Plains, N.J.*

Baseboard Diffuser Features Snap-Together Face and Base

Two piece baseboard diffuser does not require screws for installation. Back plate of base section has two tabs for holding register boot in place. Has 36 sq in. of free area. Knockouts in the base permit use with 12 by 2¼ in. and 14 by 2¼ in. register boots. — *Excelsior Steel Furnace Co., 546 W. Washington Blvd., Chicago 6, Ill.*

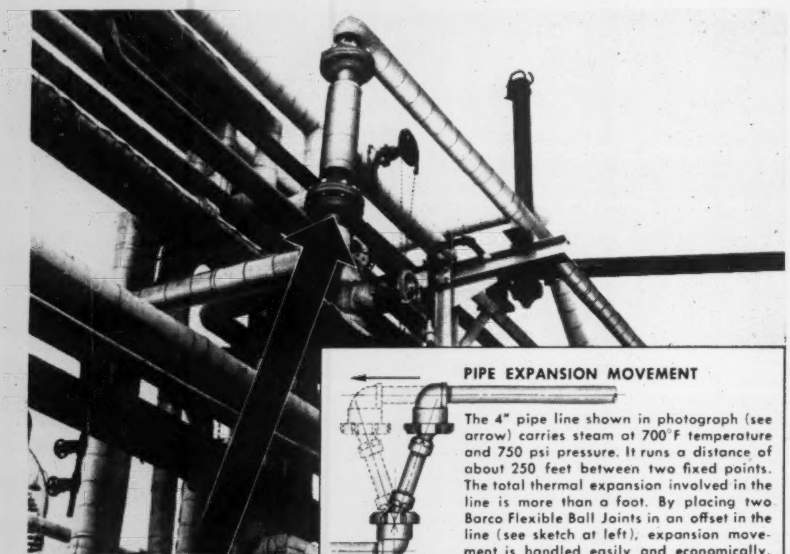
Floating Slide Cradle For Baseboard Heating Element

Snaps on to heating element. Prevents the element fins from coming into contact with either the enclosure panel or the supporting brackets, eliminating a possible cause of noise during heating and cooling cycles. Allows a full flow air movement through the fins, preventing any unsightly streaking of walls. Cradle is standard equipment on model "LD20U Beautybase" baseboard. — *Continental Mfg. Co., P.O. Box 4048, Baltimore 22, Md.*

Deaerator Reduces Oxygen Content Of Boiler Water Below 0.005 CC Per Liter

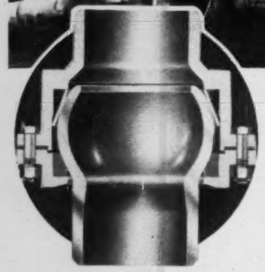
Packed column deaerator reduces the carbon dioxide level to zero in addition to reducing oxygen content. Available in seven models with ratings ranging from 1500 lb per hr at 50 F to 55,000 lb at 150 F. Carbon steel storage tanks for deaerated water range in capacity from 53 to 1012 gal. — *Aqua-Chem, Inc., 225 N. Grand Ave., Waukesha, Wis.*

How Plant Handles 700°F. STEAM . . . PIPE EXPANSION



PIPE EXPANSION MOVEMENT

The 4" pipe line shown in photograph (see arrow) carries steam at 700°F temperature and 750 psi pressure. It runs a distance of about 250 feet between two fixed points. The total thermal expansion involved in the line is more than a foot. By placing two Barco Flexible Ball Joints in an offset in the line (see sketch at left), expansion movement is handled easily and economically. (PHOTO: Esso Standard Oil Co., Linden, N. J.)



BARCO HT HIGH TEMP. Flexible BALL JOINTS

SAVE VALUABLE SPACE

The Barco HT (High Temperature) Flexible Ball Joint is a new development. It is *the key* to solving many PIPE EXPANSION PROBLEMS where high temperatures and pressures are encountered. HT joints can be supplied in sizes from 2" to 16", angle or straight, and can be fabricated from materials to withstand as much as 1000°F, 1200°F, or even 1400°F, under certain conditions.

Rugged "Fire-Safe" Barco joints have no thin wall sections, no critical points of fatigue, no rubber seals. They develop no "end thrust". . . *no reactive forces;* require no expensive anchoring. They are ideal for steam and all kinds of fluids.

Local Barco Field Engineers will be glad to give you full information and recommendations. Call or write today.

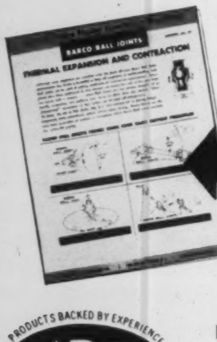
ADVANTAGES:

SAVE SPACE — Barco Ball Joints are used to perform functions similar to U-bends or pipe loops — But with much less space required and often LOWER COST.

NO PRESSURE THRUST — Expensive anchoring or bracing not required to hold piping in place or in line.

HIGH TEMPERATURE, PRESSURE — Wide choice of materials in new Barco HT Joints.

SIMPLE — Eliminates much tedious pipe stress analysis calculation.



Send for this BULLETIN 31

"How To Use Barco Expansion Joints". Complete with piping layout drawings and illustrations. Shows how to cut costs, save time, and do a better job!

PRODUCTS BACKED BY EXPERIENCE
BARCO
FOUNDED 1908

BARCO MANUFACTURING CO.
541M Hough Street • Barrington, Illinois

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Rotary Joints
In Canada: The Holden Co., Ltd., Montreal

EQUIPMENT DEVELOPMENTS

Continued

Warm Air Heaters For Large Buildings

Available in "Hi-Boy," down flow. and horizontal models for space heating or duct systems in multi-room and multi-zone installations. "F" series offered in eight output capacities from 200,000 to 2,000,000 Btu per hr. Uses gas, light oil, heavy oil, or gas-oil combination. Twin blowers move from 2450 to 24,400 cfm at 140 F discharge temperature, and are powered by motors from ½ to 7-½ hp. Units are adaptable for summer cooling. Features welded stainless steel combustion chamber, access panels for easy adjustment, and blower motor in the open for cool operation. — *Campbell Heating Co., 3123 Dean Ave., Des Moines* 17, *Ia.*

Year Around Air Conditioners For Roof-Mounted Installations

Range in size from 5 to 35 tons cooling and 150,000 to 600,000 Btu per hr heating. Gas or oil fired. Units weigh from 1200 to 5000 lb. Feature mechanical draft, electric ignition, jet-type flame for the heating, balanced dampers, a potentiometer damper motor, and automatic controls. — *Welbilt Air Conditioning & Heating Corp., Farmingdale, N.J.*

Contactors, Starters for Air Conditioning, Heating

New models of 20, 25, and 70 amp have been added to previous line of 30, 40, 50, and 60 amp contactors and starters. All units rated up to 600 v. Units to 40 amp have baseboard design that allows for interchangeability with other makes. All units feature straight-through wiring to speed installation. — *General Electric Co., Schenectady* 5, *N.Y.*

STEEL PIPE BY WHEELING

SO EASY TO USE... SO HARD TO ABUSE!

"MADE IN U.S.A." is stenciled on Wheeling Pipe for your protection!

The name "Wheeling" on the pipe you use is mighty important. For it's positive assurance that the pipe you use is "*so easy to use . . . so hard to abuse!*" Here's why:

So easy to use because Wheeling Continuous Weld Steel Pipe always has even wall thickness and accurate circumference. It cuts . . . bends . . . welds . . . and threads easily, quickly every time.

So hard to abuse because Wheeling Pipe is made from uniform, top-grade steel . . . and produced in America to *exacting* American standards. You are sure that Wheeling Steel Pipe, both black and galvanized, will withstand the rugged abuse that's the natural part of every construction job.

Order a supply of Wheeling Continuous Weld Steel Pipe from your Wheeling Jobber this week. Wheeling Steel Corporation, Wheeling, West Virginia.

IT'S WHEELING STEEL!

District Sales Offices at Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco, Wheeling.

FLEXIBLE METAL HOSE & TUBING

HEAT RESISTANCE + PRESSURE RESISTANCE
+ CORROSION RESISTANCE + FLEXIBILITY

ALLIED . . . your **COMPLETE** source for products and services designed to solve every pipeline flexation problem.

- **Absorb and isolate vibration.**
- **Reduce noise.**
- **Compensate for expansion and contraction.**
- **Take up slight pipeline misalignment.**
- **Minimize unbalance and excessive wear.**
- **Reduce maintenance time and cost.**

ALLFLEX
FLEXIBLE PIPE CONNECTORS
ALLFLEX
VIBRATAMERS

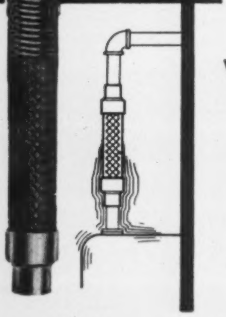
ALL STANDARD PIPE SIZES
thru 16" in Stainless Steel
8" in Bronze
4" in Monel
with Threaded, Flanged, Tube, or Pipe ends.

Standard, stock units for TODAY shipment . . . Custom engineered units for shipment "TOMORROW" . . . to solve your pipeline motion problem.

ALLFLEX "CVT"
COPPER TUBE
VIBRATAMERS

. . . specifically designed to absorb continuous vibration under extreme conditions . . . made of special tin bronze alloy.

ALL SIZES—¼" thru 8"
IMMEDIATE DELIVERY FROM STOCK



Write, wire, phone today for your **ALLFLEX DATALOG** and the name and address of your nearest **ALLIED FLEXOLOGIST**

Heating, Airconditioning & Piping Division

ALLIED METAL HOSE CO.

3745 Ninth Street, Long Island City 1, N.Y. • N.Y.C. Phone: 212-St. 4-5173

EQUIPMENT DEVELOPMENTS

Continued

Floor System Supplies Air and Electrical Services

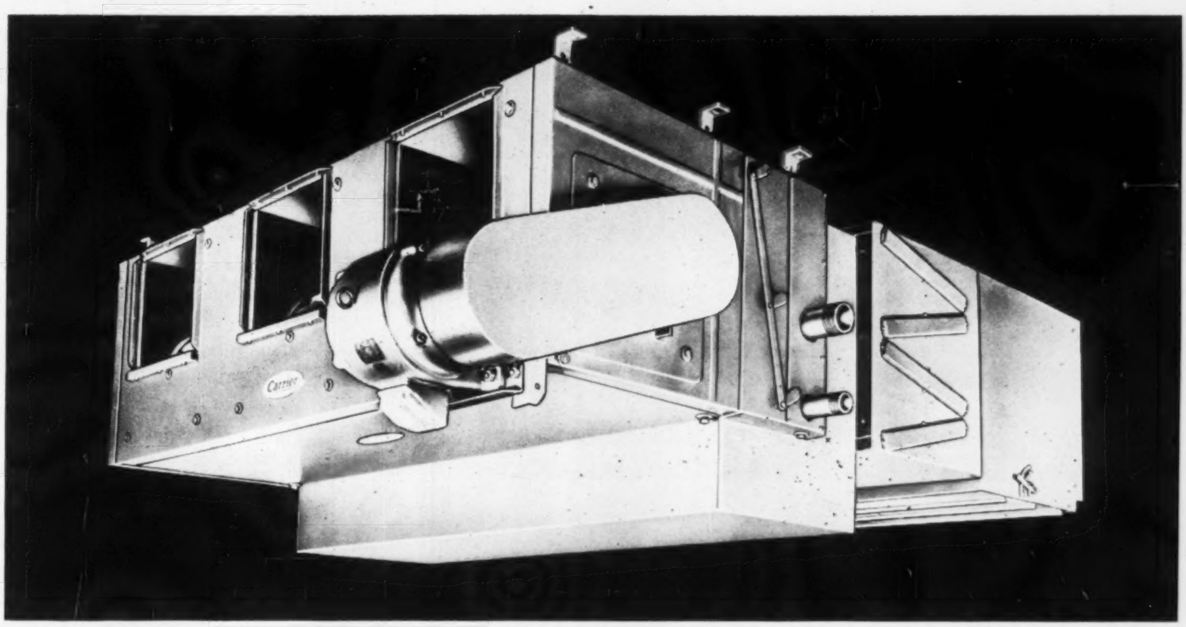
"A-E (air-electric) Floor" system provides for all the conditioned air and the cells needed for power, telephone, and other wiring. May be used with any structural system, new or old. Consists of a floor supported by the main slab. Floor rests on adjustable steel supports, creating an air space plenum for conditioned air to be carried to floor and ceiling air diffusers. Plenum can be varied in height, and can be sub-divided with baffles to provide zoning. A network of cells at predetermined spacing carries wires for the various electrical functions. — *Granco Steel Products Co., 6506 North Broadway, St. Louis Mo.*

Tube Benders Make Bends Up To 270 Deg

Two models available: three position bender has three selective starting positions for bends up to 90, 180, or 270 deg. Calibrated for bend angles, and is available for ⅜, 7/16, and ½ in. OD tubing. A double action bender is used in normal manner for bends up to 90 deg. Over 90 deg, the pivoted bending handle is lifted and repositioned at the start-in point. Available for ⅜ in. OD tubing. — *Imperial Eastman Corp.,* 6300 *W. Howard St., Chicago* 48, *Ill.*

Power Gas Burners Deliver Up to 1,000,000 Btuh

Delivery ranges from 400,000 to 1,000,000 Btu per hr. Control systems are for use with either 24 or 115 v, thermostat or controller. Gas input is adjusted by metering valve. Primary and secondary air adjustments are made by closing or opening the radial-type air shutter. — *The Barber Mfg. Co.,* 1052 *E.* 134*th St., Cleveland* 10, *Ohio.*



Carrier 46PQRV Units have heating capacities ranging from 50,900 to 2,990,000 Btu per hour, air handling capacities from 1500 to 31,000 cfm. Base units arrive at job site factory-assembled, the accessories individually crated, for easy handling and installation.

YOU GET WIDE SELECTION FLEXIBILITY PLUS SUBSTANTIAL HEATING ECONOMY

with Carrier Heating and Ventilating Units!

For heating all types of large industrial and commercial buildings, Carrier 46PQRV Units offer many definite advantages. They are also ideally suited for heating "make-up" air to prevent infiltration of cold air around windows and doors. By maintaining positive building pressures, they effect substantial savings in operating costs. And, because of their wide flexibility of application, they offer an economical "tailor-made" installation.

How wide is this flexibility? Here are some examples:

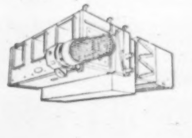
- There's a complete choice of steam or hot water coils for each of seven basic unit sizes. This makes it practical and economical to match heating capacities to individual job needs.
- Fan sections, complete with V-belt drives and multiple outlets, permit a range of air handling capacities and discharge arrangements.
- Fan assemblies, designed to run well below their critical speeds, operate smoothly and quietly—either as free discharge units or with ductwork.
- There's also extreme flexibility in the selection of controls and accessories.

For complete information and Catalog 46PQRV111, write or call your Carrier representative listed in the Classified Telephone Directory under "Heaters—Unit" or write Carrier Air Conditioning Company, Syracuse 1, New York.

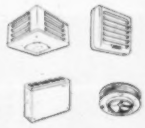
Carrier

Air Conditioning Company

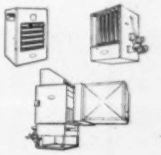
CARRIER OFFERS EVERY TYPE OF EQUIPMENT FOR ANY JOB



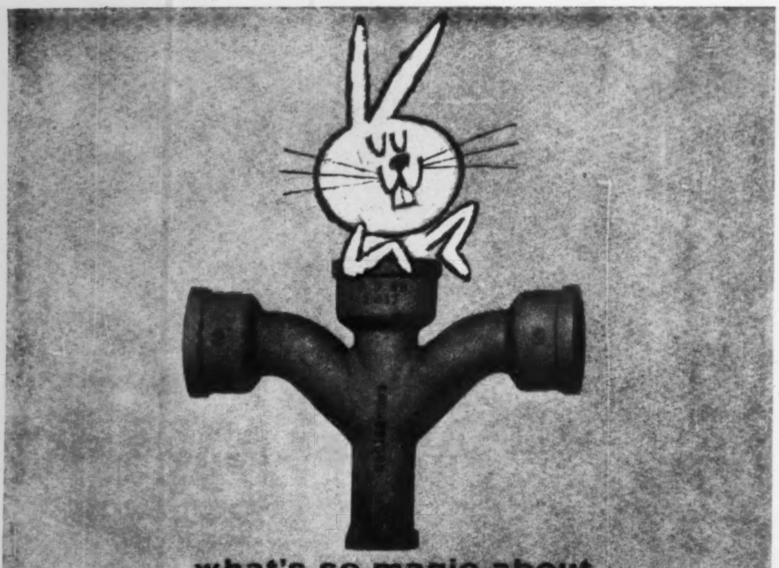
Heating and Ventilating Units for steam and hot water



Unit Heaters for steam and hot water



Gas Unit Heaters and Duct Furnaces



what's so magic about

CORROSIRON

for acid-resistant drain lines? If you've been using that *other* HIGH-SILICON IRON PIPE: You already know the *magic material* for acid-resistance . . . but the *magic service* your Corrosiron representative can give you will be new. He can't pull pipe and fittings out of a hat, but he can pull them out of a warehouse and have them on the jobsite when you need them.

ALBANY
Joseph A. Walsh & Co.
HE 6-9696
ALBUQUERQUE
Charles G. Davis
ALpine 6-0104
ANCHORAGE
M.L. Chase Company
BRoadway 2-5922
ATLANTA
Bradford Sales Co., Inc.
TRinity 5-2527
BALTIMORE
R. B. Fulton Co.
BElmont 5-4161
BILLINGS
Clapper Co., Inc.
AL 2-5511
BIRMINGHAM
Durham & Ozier Company
ALpine 1-7105
BOSTON
Pipe Founders Sales Corp.
DAvenport 4-3920
BUFFALO
R. E. Grimm
TR 7-0355, area code 716
CHARLESTON
The Reliable Sales Co.
DIckens 2-2276
CHARLOTTE
J. Larry Batts
EXpress 9-6961
CHICAGO
Sullivan and Love
STate 2-2626
CINCINNATI
Corcoran-Orth Company
MOntana 1-7919
CLEVELAND
The BWA Co., Inc.
HEnderson 1-6484
COLUMBUS
The BWA Co., Inc.
HUdson 6-7089
DALLAS
Henry F. Wood & Associates
RIverside 8-4474
DENVER
Roath-Biggs, Inc.
TAbor 5-3289
DES MOINES
Products, Incorporated
ATlantic 8-5739
DETROIT
Elmo G. Liddle
VErmont 7-5312
GRAND RAPIDS
J. R. Thomas
GLendale 4-2500
HONOLULU
Arthurs Hawaii, Ltd.
Phones: 67-635 65-012
HOUSTON
H. D. Grant Company
JAckson 9-1777 and JA 9-0718
INDIANAPOLIS
Corcoran-Pindell Company
AX 1-1013
JACKSON
Harwell & Rosselot
DR 2-3139
JACKSONVILLE
R. A. Litkenhaus & Assoc., Inc.
EL 5-3659 and EL 3-8273
KANSAS CITY
Rivard Sales Company, Inc.
TAlbot 2-3087
KNOXVILLE
Harwell & Rosselot
Telephone 7-8521
LITTLE ROCK
Harwell & Rosselot
FRanklin 4-5294
LOS ANGELES
Bartlett-Snow-Pacific, Inc.
RAymond 3-0141
LUBBOCK
Harlan Engineering Co.
POrter 3-4617
MEMPHIS
Harwell & Rosselot
BRoadway 4-2976
MIAMI BEACH
R. A. Litkenhaus & Assoc., Inc.
FRanklin 1-8015
MILWAUKEE
Nelson & Glass
HI 5-4338
MINNEAPOLIS
Harley Turner Company
JUniper 8-1669
MONTREAL
Aram A. Papasian
AVenue 8-4963
NASHVILLE
Harwell & Rosselot
ALpine 5-9907
NEW ORLEANS
Jos. Tanet
JAckson 5-3656
NEW YORK
Borin, Frankel & deLisser
RAvenswood 1-6087
OKLAHOMA CITY
Henry F. Wood & Associates
WIndsor 2-1876
PHILADELPHIA
Wall and Holloway, Inc.
LOcust 3-9310
PHOENIX
Ted Stahr
ALpine 3-6279
PITTSBURGH
Busch Co.
EMerson 2-6000
PORTLAND
George J. Scott Company
CApital 2-6816
RALEIGH
W. T. Heathcock, Jr.
TE 4-6529
RICHMOND
Equipment Sales Co., Inc.
EL 9-0070 and EL 8-2665
ST LOUIS
Heinkel Sales Service
MIssion 7-0459
ST. PETERSBURG
R. A. Litkenhaus & Assoc., Inc.
ORange 1-4454
SALT LAKE CITY
A. E. Smothers
EL 5-9545
SAN FRANCISCO
Bartlett-Snow-Pacific, Inc.
MIssion 7-1104
SEATTLE
A. Grant Burr
MAin 4-4294
SYRACUSE
Joseph A. Walsh & Company
GR 4-1089
TOLEDO
The BWA Co., Inc.
GReenwood 5-3460
TORONTO
M. A. Stewart & Sons Ltd.
Phone: 239-7348 — Area Code 416
VANCOUVER
Don Mantle Ltd.
MUtual 3-8016
WASHINGTON, D.C.
Barnett & Benner
LA 6-9142 and LA 6-5353

B-S-P
ENGINEERED EQUIPMENT

BARTLETT-SNOW-PACIFIC, Inc. SAN FRANCISCO • NEW YORK • CLEVELAND

EQUIPMENT DEVELOPMENTS

Continued

Vibration Absorbers Feature Wire-Reinforced Rubber Walls

Constructed with a smooth inside lining of pure gum rubber. Flexing action keeps the rubber free from scale formation. Wire-reinforced walls are made from multiple plies of rubber-impregnated fabric, with helical wire embedded in the fabric carcass. Feature integral full-faced rubber flanges with steel flanges embedded behind the rubber flanges for either 150 or 250 psi service. Maximum temperature is 200 F for standard models; a "Neoprene-Dacron" unit is available for operations up to 250 F. Available in all standard pipe sizes. — *General Rubber Corp., 68 Summit St., Tenafly, N.J.*

Six Speed Electric Drive Has Remote Control Panel

Available in 20, 25, 30, and 40 hp models. Hydraulic clutches activated by electric solenoids shift the drive to any six speeds while running under full load. Control panel can be installed any distance from drive. Unitcast, semi-steel gearbox assures permanent alignment of all working parts. Can be operated in either reverse or forward in all six speeds. — *The Lima Electric Motor Co., Inc., Lima, Ohio.*

Centrifugal In-Line Fans Move Up To 300,000 Cfm

Available in Class I, II, III, IV, and V construction for high pressure and conventional air conditioning, ventilation, and industrial process applications. Can create static pressures up to 15 in. WG in appropriate systems. Features directional flow wheels with die-formed blades and shroud. — *Dryer Dynamics Corp., Page & Schuyler Aves., Lyndhurst, N.J.*

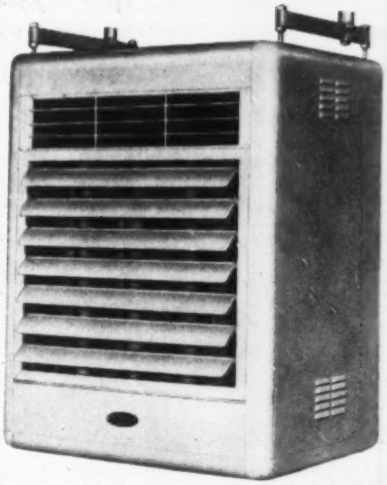
When You | **SELL or REPLACE**

UNIT HEATERS or DUCT FURNACES

ORDER

Hastings

Because They **DO NOT** ***RUST*** or ***BURN OUT*** and **Are Fully Guaranteed For 10 Years!**



BLOWER MODELS

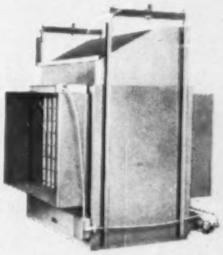
For extremely quiet operation.

Open or Enclosed Blower Models.

DUCT FURNACES

May be close-coupled for any total capacity.

Low air pressure drop.



THE SUPER-FEATURE LINE

Fan Models — Blower Models

Duct Furnaces

25,000 to 900,000 Btu's

Aluminized or Stainless Steel

Industrial and Make-up Air Heating

Heavy 18 Gauge 100% Welded

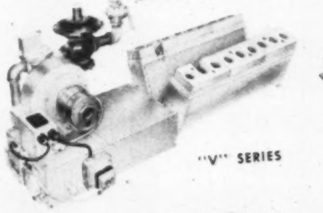
Duct Furnaces AGA Approved For Downstream Use

AVAILABLE WITH

Dual Fuel	Adjustable Air By-pass
Modulation	High Velocity Nozzles
2 Stage Valve	High Pressure Regulator
Electric Ignition	115 or 24 Volt

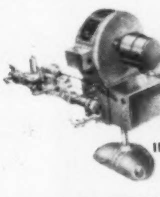
GAS POWER BURNERS

Unconditionally Guaranteed



"V" SERIES

- 400,000 up to 8,000,000 Btu.
- No Combustion Chamber Required
- Saves $100 to $500 On Every Job



INSHOT SERIES

- 70,000 to 700,000 Btu.
- Simple Control System
- Easy to Service

ASK FOR BULLETIN H-11-GB

HASTINGS AIR CONTROL

Omaha 5, Nebr.

BONNEY WELDOLETS

cut corners safely...

ON ALL 90° BRANCH PIPE CONNECTIONS

Competitive economic times like these make cost cutting mandatory. Reduce piping costs by using Weldolets instead of welding tees for all full size and reducing branch connections. Contractors and owners are saving thousands of dollars on piping jobs by switching to Weldolets. Are you? Write for information.

BONNEY

also exclusive manufacturers of
WELDOLETS®
THREDOLETS®
SOCKOLETS®
ELBOLETS®
BRAZOLETS®
SWEEPOLETS®
• • • • • • • • • • •
CARBON STEEL
STAINLESS
ALLOY
for all services

BONNEY FORGE AND TOOL WORKS, ALLENTOWN, PA.

EQUIPMENT DEVELOPMENTS

Continued

Rubber Expansion Joints Have One-Piece Construction

Abrasion resistant rubber has been compounded for flexibility. Joints are reinforced with heavy-weight duck, and are coated on the outside with "Neoprene" to prevent oxidation or damage from oil or grease. "Neoprene" also available as inside lining or body material. Standard spool type joints available for pipe sizes from 2 to 72 in. Vacuum type joints are designed for 30 in. of mercury and pressure type joints for 0 to 150 psi, depending on size. Special joints can be designed in tapered, rectangle, oval, or other shapes, for acids, gases, chemicals, etc. — *Crane Packing Co., Dept. HA-8, 6400 W. Oakton St., Morton Grove, Ill.*

Spring Isolation Mount Stops Vibration and Noise

Utilizes a single helical coil steel spring with load-carrying capacities ranging from 50 to 540 lb. Cast semi-steel housing measures 3-3/4 by 3-1/4 by 5-1/8 in. An access port on each side permits interior inspection, facilitates cleaning, and enables changing of spring. Features an external leveling device. — *The Korfund Co., Inc., OIF Cantiague Rd., Westbury, L.I., N.Y.*

Suspended Furnaces Offered In Capacities to 450,000 Btuh

Five sizes of 85,000 to 335,000 Btu per hr are available in addition to capacities of 224,000, 280,000, 350,000, and 450,000 Btu per hr. Feature 12 gage primary and secondary heat exchangers with stainless steel combustion chambers. Units are oil fired. —*Quiet Automatic Burner Corp., P.O. Box 9022, North Station, Newark 4, N.J.*

Marsh Makes It!

If it's a pressure gauge, dial thermometer, or needle valve, Marsh makes it...makes it in every form to suit every need...makes it better in the opinion of thousands of discriminating users. Only a few key products are illustrated here, but hundreds are described in Marsh Catalogs. Ask for information covering the product or products in which you are interested.

PRESSURE GAUGES

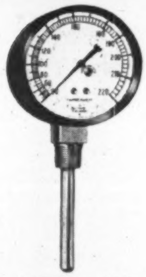
"Mastergauge"—the world's most effective pressure gauge for extreme service.

"Master-test"—"Mastergauge" quality in a gauge for services requiring high accuracy.

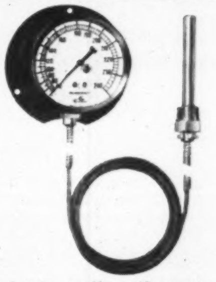
Quality series—second only to "Mastergauge" and "Master-test" for tough conditions.

Standard series—best moderate-priced gauge for run-of-plant conditions.

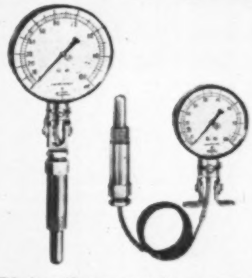
DIAL THERMOMETERS



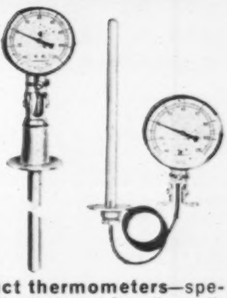
Vapor tension thermometers—direct mounted type. Many sizes; ranges.



Distant reading thermometers—vapor-tension and gas filled types in many sizes; ranges.

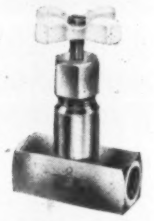


Piping thermometers—specially designed for piping. Types for all purposes, including distant reading.

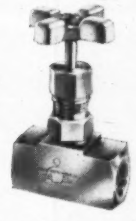


Duct thermometers—specially designed for all conditions including distant reading.

NEEDLE THROTTLING VALVES

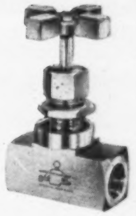


Alloy steel—complete series of sizes and patterns. Pressures up to 10,000 psi.



416 Stainless steel—complete series of sizes and patterns in 416 stainless. Pressures up to 10,000 psi.

316 Stainless steel—complete series of sizes and patterns in 316 stainless. Pressures up to 6,000 psi.



Panel mounted—all valves—alloy steel, 416 stainless, and 316 stainless—available in panel mounted types.

MARSH

MARSH INSTRUMENT COMPANY, Dept. T, Skokie, Ill.
Division of Colorado Oil and Gas Corporation
Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada.
Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas.
Eastern Seaboard Warehouse: Marsh Instrument Company, 1209 Anderson Ave., Fort Lee, N.J.

Rely on dependable
BASMOR
Automatic Sunshine
to meet big heating demands!

AUTOMATIC SUNSHINE is radiant hydronic heating with a Basmor Boiler. The healthful even, sun-like warmth of heat by radiation, whether from radiant baseboard, panels, convectors or conventional radiators.

Basmor Gas-Fired Boilers in sizes to meet commercial, institutional and industrial heating demands efficiently and economically. For all steam, hot water or vapor systems, and large volume water heating by the indirect method.

engineered for fast installation, simplified servicing, minimum operating costs!

Basmor 400 Series (Water Boiler shown above) in ten sizes from 375,000 to 1,050,000 BTU input. Top combustion efficiency with cast drill port burners and finest controls. Maximum utilization through patented "staggered heat travel" cast iron section design.

Basmor 600 Series (Steam Boiler at right) in thirty-six sizes from 725,000 to 5,800,000 BTU input, permits "tailored-to-the job" selection to accurately meet heating requirements. Yes, you can rely on Basmor Automatic Sunshine for big heating demands! Write for complete information.

Basmor-Little
BASTIAN-MORLEY CO., INC.
(Incorporating H. C. Little Burner Co., Inc.)
LaPorte, Indiana
Basmor-Little Boilers, Furnaces, Gas Heaters, Water Heaters, Incinerators

EQUIPMENT DEVELOPMENTS
Continued

Air Conditioning Units Provide Zone Control

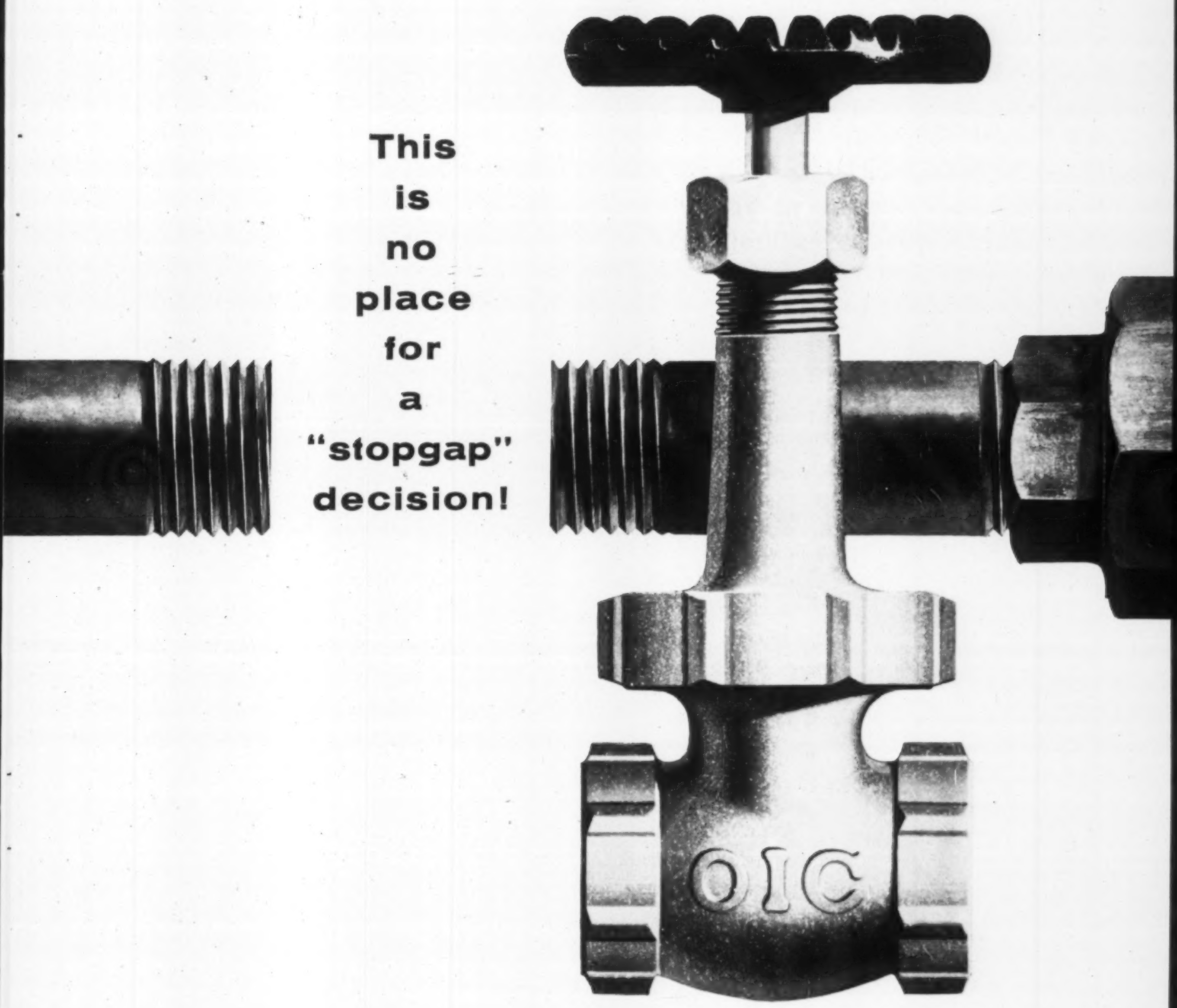
Available for cooling with the "Zoneline 42" or heating and cooling combined with the "Thermaline 42" heat pumps. Units are of through-the-wall design, and can be integrated into any heating system. Air conditioner features an adjustable baffle front to provide alternate air direction flows. Also features a positive condensate water disposal system with no moving parts that removes condensate by creating a miniature water spout which is blown on the condenser coil as fine mist. Available in cooling capacities to 14,500 Btu per hr and heating capacities to 14,000 Btu per hr. — *General Electric Co., One Progress Rd., Shelbyville, Ind.*

Scale and Oxide Remover Has Inhibited Action

Solutions of the compound may be heated to 180 F for use in closed systems. Has a degree of inhibition in the vapor stage of the solution; a tolerance for sulphur dioxide and ferric ions; and reduces the hazard of copper ions depositing on steel. Also has rinsability with hot or cold water. — *Oakite Products, Inc.,* 151*B Rector St., New York 6, N.Y.*

Temperature Regulator Controls Small Loads at Low Pressures

Available in sizes up to 2 in. with bronze body and union ends. Responsive vapor tension thermostats available for most temperature ranges between the limits of 50 and 250 F. Can be used with a differential as low as 3 psi between inlet and outlet pressure. Single-seat construction and stainless steel trim provide positive shut-off — *Spence Engineering Co., Inc., 32 Grant St., Walden 2, N.Y.*



For dependable valve performance . . . specify O I C

Hasty "stopgap" decisions may be luxuries you cannot afford. The cost of a valve for essential plant services is very small compared with the high costs of interrupted production, excessive maintenance and early replacement. Specify the valve that is built for complete operational reliability, long life and minimum maintenance.

Play it safe . . . specify O I C. Your nearby O I C distributor has a complete line of bronze and iron valves designed to withstand strain, vibration, shock and pressure changes under many different operating conditions. You make the right decision when you specify O I C.

The Ohio Injector Company, 235 Main Street, Wadsworth, Ohio

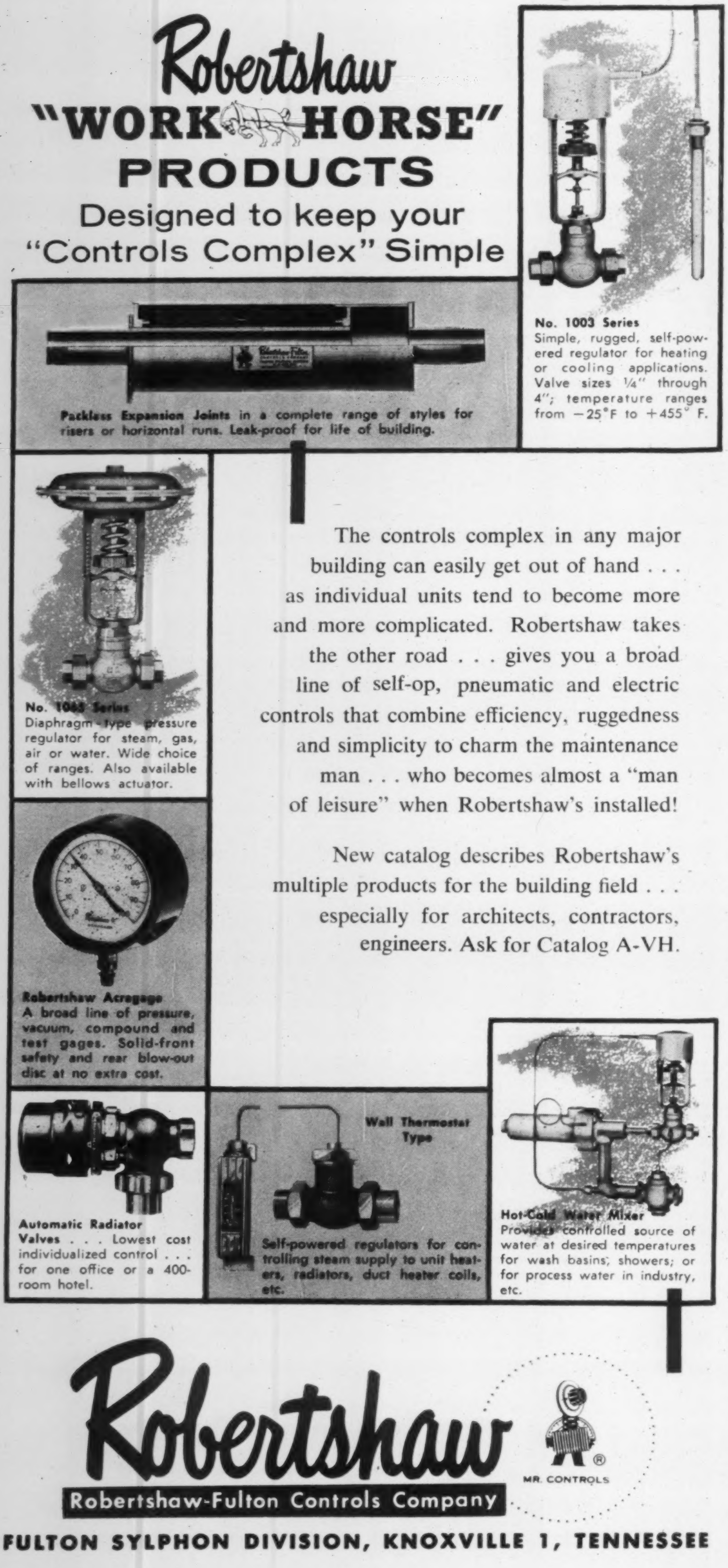
THE FINEST VALVES AND DISTRIBUTOR SERVICE FROM OIC

INDUSTRIAL DISTRIBUTORS
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

OIC VALVES

**BRONZE, IRON,
FORGED STEEL,
CAST STEEL AND
DUCTILE IRON
VALVES**

10232-OIC



Robertshaw
"WORK HORSE"
PRODUCTS
Designed to keep your
"Controls Complex" Simple

Packless Expansion Joints in a complete range of styles for risers or horizontal runs. Leak-proof for life of building.

No. 1003 Series
Simple, rugged, self-powered regulator for heating or cooling applications. Valve sizes ¼" through 4"; temperature ranges from −25°F to +455° F.

No. 1065 Series
Diaphragm-type pressure regulator for steam, gas, air or water. Wide choice of ranges. Also available with bellows actuator.

The controls complex in any major building can easily get out of hand . . . as individual units tend to become more and more complicated. Robertshaw takes the other road . . . gives you a broad line of self-op, pneumatic and electric controls that combine efficiency, ruggedness and simplicity to charm the maintenance man . . . who becomes almost a "man of leisure" when Robertshaw's installed!

New catalog describes Robertshaw's multiple products for the building field . . . especially for architects, contractors, engineers. Ask for Catalog A-VH.

Robertshaw Acragage
A broad line of pressure, vacuum, compound and test gages. Solid-front safety and rear blow-out disc at no extra cost.

Automatic Radiator Valves . . . Lowest cost individualized control . . . for one office or a 400-room hotel.

Wall Thermostat Type

Self-powered regulators for controlling steam supply to unit heaters, radiators, duct heater coils, etc.

Hot-Cold Water Mixer
Provides controlled source of water at desired temperatures for wash basins; showers; or for process water in industry, etc.

Robertshaw
MR. CONTROLS
Robertshaw-Fulton Controls Company
FULTON SYLPHON DIVISION, KNOXVILLE 1, TENNESSEE

EQUIPMENT DEVELOPMENTS

Continued

Tapered Plug Valves Use High Lubricity Plastic Coating

"Permaturn" valves feature 0.0005 in. coating applied to tapered surfaces. "Teflon" is used for pressures up to 1000 psi; phosphate-molybdenum is used for pressures up to 10,000 psi. Fixed adjustment assembly of low pressure valves maintains a tight seal after repeated openings and closings. High pressure units feature a threadless stem. Available from ¼ to 36 in. for WOG service. Made of cast semi-steel; carbon alloy, and stainless steels; forged steel; and non-ferrous materials. Conventional plug openings are supplemented by V and diamond port designs. — *Rockwell Mfg. Co., Meter and Valve Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.*

Boiler Drain For Sweat or Threaded Connections

Accommodates both pipe thread and sweat connections in one valve. Available in ½ or ¾ in. sizes. Supplied with or without stuffing box — *American Valve Mfg. Co., 22 Bayview Ave., Manhasset, L.I., N.Y.*

Hot-Oil Heaters Deliver Up To 13,000,000 Btuh Input

Three models available with capacities of 7,000,000; 13,000,000; and 300,000 Btu per hr. Can achieve temperatures to 600 F by means of heat transfer oils. Pressures are kept to a minimum, enabling savings in piping costs and creating additional safety. Units modulate automatically, and do not require water treatment. — *Vapor Heating Corp., 80 E. Jackson Blvd., Chicago 4, Ill.*

Michigan Consolidated Gas Company

DETROIT, MICHIGAN

New Forms and Systems Achieve Striking Effect of Soaring Grace

AEROFIN INSTALLED

to temper the air delivered to the unique new variable volume reheat window units.

Modern smooth-fin design of Aerofin coils permits ample heat-exchange capacity in limited space. Where desired, it also permits the use of high air velocities without turbulence or excessive resistance.

Aerofin performance data are laboratory and field proved. You can safely specify Aerofin coils at full published ratings.

Aerofin hot-water heating coils (illustrated) and chilled-water cooling coils contribute to the year-round comfort of this outstanding new building.

Minoru Yamasaki—Smith, Hinchman & Grylls
Associated Architects and Engineers

Bryant & Detwiler Co.
General Contractors

Glanz & Killian Co. • **J. Brodie & Sons**
Mechanical Contractors

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N. Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

ENGINEERING OFFICES IN PRINCIPAL CITIES

AMCA Certified Ratings

YOUR ASSURANCE
OF PROPERLY RATED PERFORMANCE
IN AIR MOVING DEVICES

The AMCA program of Certified Ratings provides assurance of properly rated performance to specifiers and users of centrifugal fans, axial and propeller fans, power roof ventilators and other air-moving devices. To qualify for license under the Certified Ratings Program, manufacturers must meet the following basic requirements:

> A manufacturer must publish performance ratings developed in accordance with AMCA's Standard Test Code, and based on tests conducted in laboratories approved by AMCA.
>
> These published performance ratings must be developed for various volumes, pressures and speeds—at a stated density...
>
> ...and are subject to periodic re-evaluation under AMCA's continuing retest program. Authority to use the Certified Ratings Seal may be withdrawn by AMCA for non-conformance with any requirement of the Program.

When you see the Certified Ratings Seal on a manufacturer's published performance data or product, you are assured that the air-moving devices you specify have been properly rated, and meet all requirements of the Air Moving and Conditioning Association's Certified Ratings Program. For additional information, mail coupon below.

CERTIFIED RATINGS
AUTHORIZED BY AMCA

AIR MOVING AND CONDITIONING ASSOCIATION, INC.
2159 Guardian Building, Detroit 26, Michigan
Please send Bulletin 153 — AMCA Certified Ratings for Air Moving Devices

NAME__________
ADDRESS__________
CITY__________ ZONE_____ STATE__________

EQUIPMENT DEVELOPMENTS

Continued

Masonry Fastening Tool Is Hammer-Driven

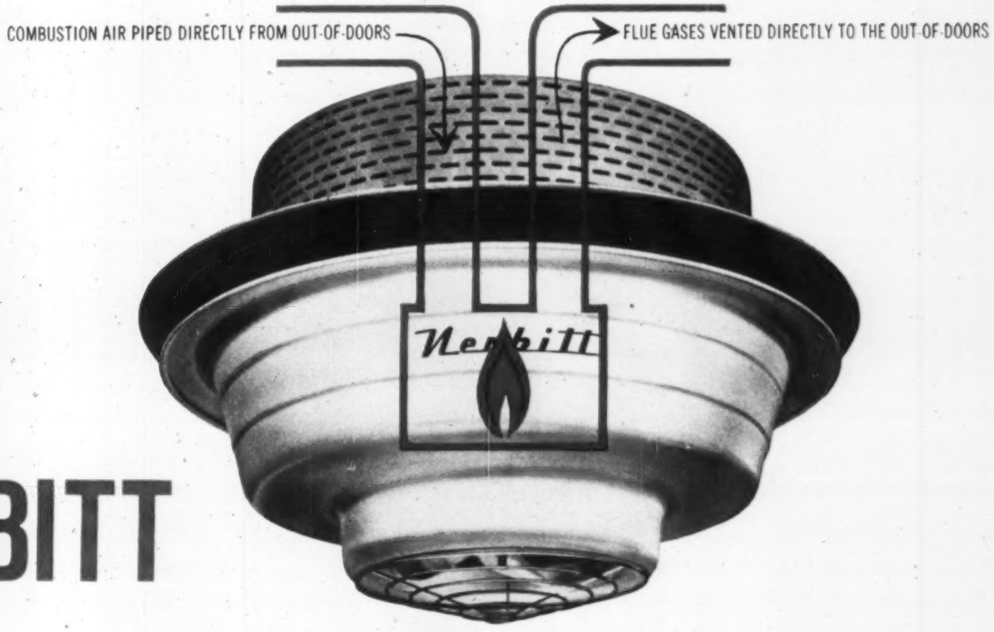
Directs a hammer's striking force straight down, driving the pin into steel, concrete, and other materials. Does not require drilling or bolting. Features a reversible barrel permitting the use of a masonry drill, changing from a pin driving position to a drilling position. Pins are available in specially alloyed and hardened steel, and in a variety of sizes and styles. — *Remington Arms Co., Inc.,* 939 *Barnum Ave., Bridgeport* 2, *Conn.*

Liquid Controls Rust and Scale; Lubricates Water Pumps

Liquid compound is a mixture of phosphate sequestering agents and chromium inhibiting compounds combined with selected surface active materials. Loosens existing scale to clean metal sufaces. Permits corrosion inhibitors to come into contact with metal. Builds up a physically absorbed organic film. Checks growth of salt crystals. Lubricates internal moving parts of circulating water pumps. — *The Grintol Co.,* 7510 *Hollywood Blvd., Hollywood* 46, *Calif.*

Two-Way Solenoid Valve for High Vibration, High Pressure

Withstands vibration of 20 to 500 cps at 10 G without shifting position, and pressures to 1000 psi. Handles diesel fuel, kerosene, and gasoline at temperatures from −65 to 150 F. Supplied in 1/8 in. pipe size with brass body and seat, and a "Viton A" disc. Explosion-proof solenoid enclosure, NEMA Type 7C, 7D, is standard. Described in form No. V5129. — *Automatic Switch Co., Florham Park, N.J.*

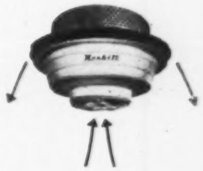

COMBUSTION AIR PIPED DIRECTLY FROM OUT-OF-DOORS
FLUE GASES VENTED DIRECTLY TO THE OUT-OF-DOORS
Nesbitt

ALL
GAS
ALL
NESBITT
ALL
YOURS

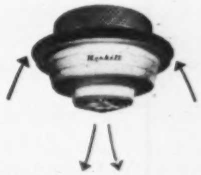
Nesbitt Gas-Fired Unit Heaters are now recognized in the trade as "the hot line"—with units to meet every type of installation where the use of gas is indicated . . . propeller-fan and blower-fan units; duct furnace; horizontal furnace; and the exclusive Sealed/Flame unit with its unique sealed combustion system. The reputation for excellence—earned by Nesbitt heating, ventilating and air conditioning equipment in more than 40 years of dependable service—commends this complete and diversified line of gas-fired units to wholesalers, contractors, and building owners. It will pay you to get the facts.

NESBITT SEALED/FLAME is a smartly styled circular unit heater with an exclusive sealed combustion system which operates completely independent of the room air. All air used in combustion is drawn from outdoors through a separate inlet; and all flue gases and combustion products are vented to the outdoors under pressure. Because there is no open flame exposed to the room, the Nesbitt Sealed/Flame is applicable where other unit heaters cannot be used, particularly in airtight rooms where dust and humidity must be controlled and spaces where exhaust fans create a negative pressure. Radial-Flo units distribute a complete circle of heated air outward and downward; while Down-Blo units reverse the flow, discharging the air directly downward. Sealed/Flame units come in two sizes: 115,000 and 85,000 Btu/hr.

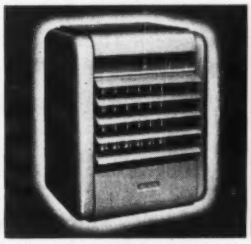
For complete details, send for Publication 400-4



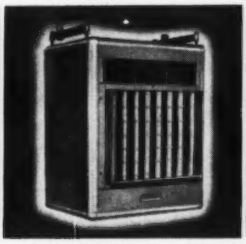
Radial Flo: a full circle of warmed air discharged outward and downward to floor; return air intake at bottom of the unit.



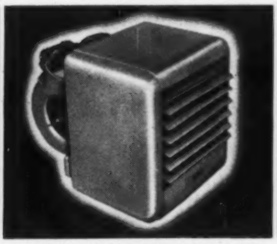
Down-Blo: air flow reversed—warmed air discharged directly downward; return air intake around top circle of the unit.



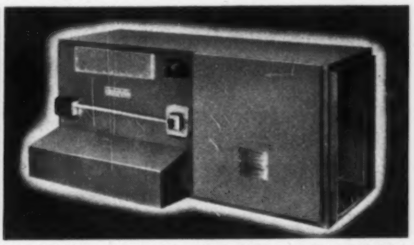
Propeller Fan Units. 10 sizes: 25 to 250 MBH input. Pub. 400-1.



Duct Furnace. 2 types, 7 sizes: 75 to 300 MBH. Publication 400-3.



Blower Fan Units. 8 sizes: 820 to 3360 cfm, 50 to 250 MBH. Publication 400-1.



Horizontal Furnace. 5 sizes: 600 to 2300 cfm; 70 to 140 MBH input; furnace, unit heater, or with cooling. Pub. 400-5.

Nesbitt

THE NAME TO GO BUY IN UNIT HEATERS

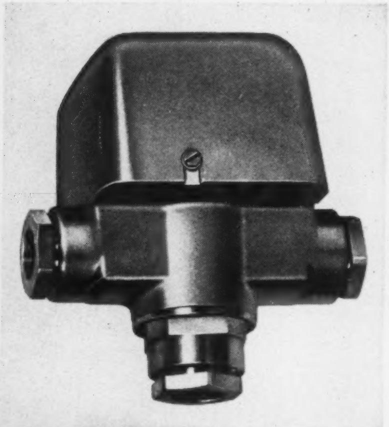
SOLD THROUGH MANY OF THE FINEST WHOLESALERS

Manufactured by John J. Nesbitt, Inc., Philadelphia 36, Pa.

Now available *

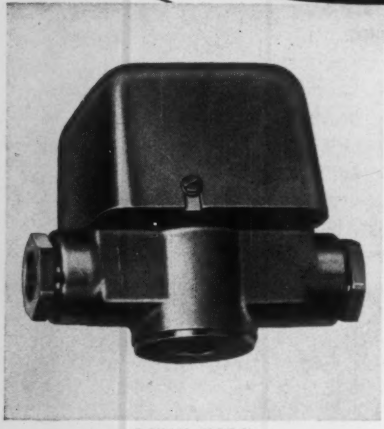
for FAN-COIL UNITS

3-WAY MODEL



Reliable
Quiet
MOTOR
OPERATED
VALVES

ERIE
motortrol
SERIES 436A



2-WAY MODEL

- quiet operation
- low cost
- compact
- easiest installation
- works in any position
- cannot plug or foul
- high flow capacities
- simple design
- 100% shut-off
- "fail-safe" operation

*WRITE FOR BULLETIN 210

ERIE MANUFACTURING CO.

TRADE NAMES: MOTORTROL • ELECTROL • TIME-O-FLOW • TIME-O-GAS • PROGRAMMATIC • ELECTROMATIC

Milwaukee, Wisconsin and (Canada) Ltd., Stouffville, Ontario

EQUIPMENT DEVELOPMENTS

Continued

Infra-Red Heating Fixtures For Outdoor-Indoor Application

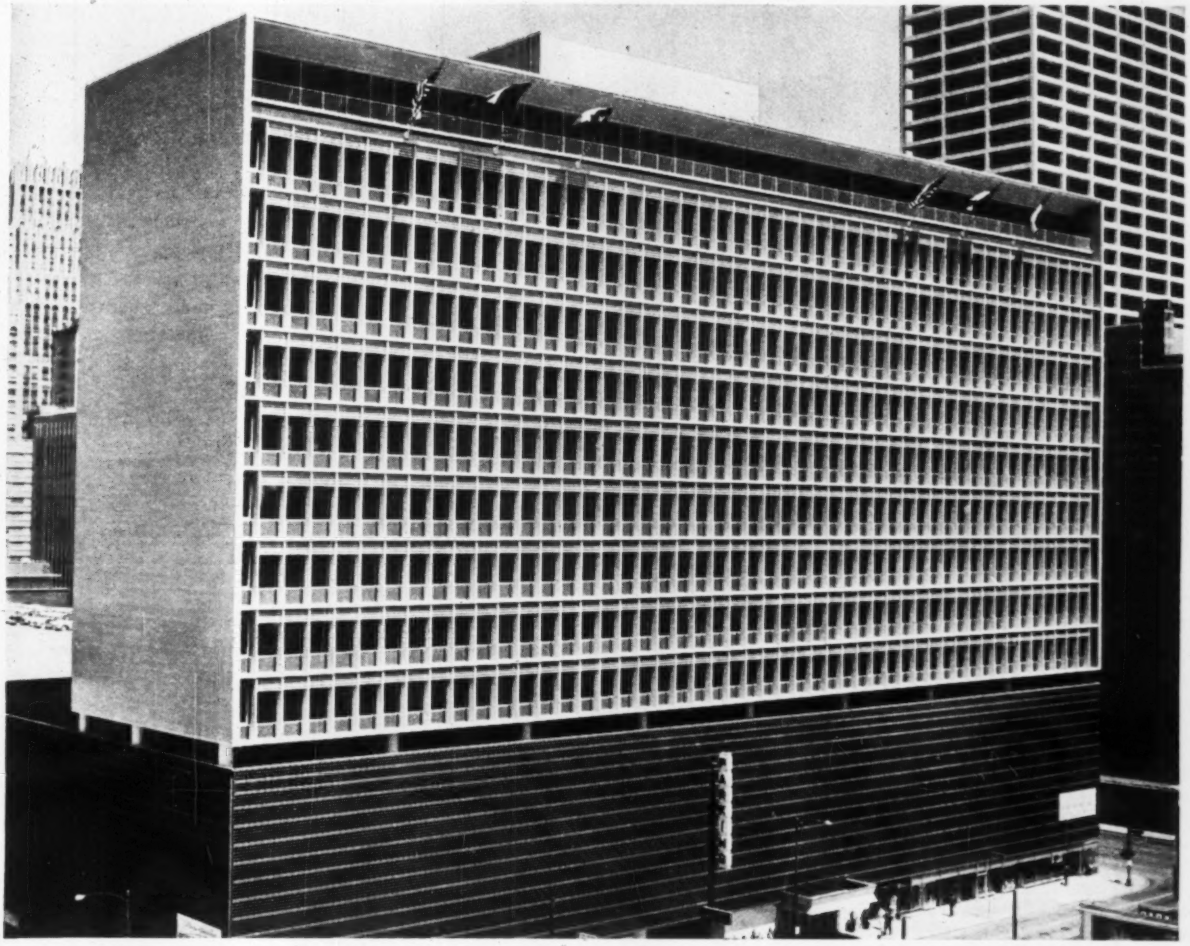
Two units available: a hanging fixture for outdoor applications may be chain mounted or supported by either a vertical or horizontal stem; the other is for mounting to horizontal surfaces, and may be used for indoor flush ceiling applications as well as outdoors. Waterproof housings and covers are made of 14 gage aluminum with baked enamel finish. Fixture reflectors are anodized aluminum. Units are equipped with two tubular quartz infra-red lamps for use where both heat and light are desired; also available are tubes for heat only. Available in 90, 60, and 30 deg radiation spread designs. — *Luminator, Inc.*, 120 *N. Peoria, Chicago* 80, *Ill.*

Separator-Trap System Removes Moisture

Removes oil and water from compressed air, gas, and steam lines. Consists of firm's type "T" separator combined with a trap. Suitable for pressures ranging from 150 to 1000 psi and for pipe sizes ½ to 8 in. Described in bulletins Nos. 810 and 811. — *Wright-Austin Co.,* 3245 *Wight St., Detroit* 7, *Mich.*

Boilers Available for Low Pressure Steam or Hot Water

Offered in a range of 12 sizes from 450,000 to 2,650,000 Btu per hr. Three pass design units are pre- and post-purged. An 80 hp model requires only 42.7 sq ft of space. Can be fired with light oil, gas, or combination gas-oil. Forced draft operation provides ample combustion air for stub stack applications. Special assemblies are available for high altitude applications. — *American-Standard Industrial Div., Detroit* 32, *Mich.*



Architect: Lloyd and Morgan
Consulting Engineer: I. A. Naman & Assoc.
Contractor: Natkin and Co.

Clean air by AAF in Houston's Americana Building

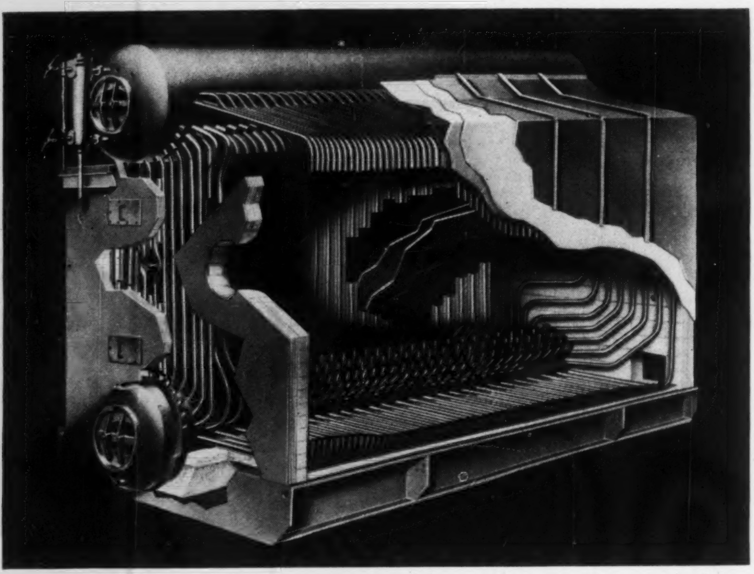
■ Planners of Houston's modern, 15-story Americana Building have provided everything to assure the finest in convenience and comfort for its tenants. For example, facilities for parking 1,000 cars are located in the building. There's a tunnel link with a large department store, and choice of 6 restaurants without going outdoors. For air-cleaning efficiency they turned to AAF — the one company that makes all kinds of filters.

From the complete AAF line, they selected the automatic ROLLOTRON to eliminate virtually all dust, dirt and pollen from the office air. The ROLLOTRON offers the efficiency of an electrostatic precipitator with the low maintenance characteristics of an automatic-renewable media filter. No oiling, no washing, no freezing, no drains. Only maintenance ever required is simple replacement of the glass fiber media roll (about once a year) and an occasional wipe down of the ionizer wires and struts.

Get all the facts. Call your local AAF representative or write direct for ROLLOTRON Bulletin 249. Address: Robert Moore, American Air Filter Company, Inc., 373 Central Avenue, Louisville, Ky. In Canada: American Air Filter of Canada, Ltd., 400 Stinson Blvd., Montreal 9, Quebec.

AAF **American Air Filter**
BETTER AIR IS OUR BUSINESS

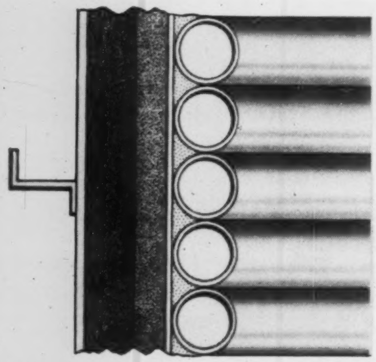
AFI MEMBER AIR FILTER INSTITUTE



BROS boosts boiler efficiency by putting heating surfaces where they should be!

Heating efficiency in Bros Series "P" Package Boilers is exceptionally high. There are many reasons.

One is the fact that a large proportion of the heating surfaces are *inside the furnace* where heat absorption is highest. A relatively small portion is located in the convection zone.



OUTER FURNACE WALL (Above) is built of welded 10-gauge steel reinforced by Z-bars. Next are 1½" and 1" blankets of medium and high temperature insulation, then 16-gauge inner casing. Trowelled refractory between tubes provides smooth surface for inner casing.

FURNACE FLOOR TUBES are bare and not covered by refractory. Space between tubes and plate is filled with loose insulation. Radiant heat prevents condensation and corrosion of tubes.

Inside the furnace, all heating surfaces are *tubes*. These provide far more direct (and consequently more efficient) heat contact than do the extended surfaces so often found inside other furnaces.

Here are some other reasons why Bros Package Boilers will give you greatest operating economy.

- **Horizontal cross-flow of gases provides maximum and efficient heat transfer.**
- **Tangent tube furnace walls provide maximum furnace heat absorption, decrease loss by radiation. Tubes on floor, sides and roof, along with coverage of rear wall, minimize furnace refractory maintenance.**
- **Deep furnace provides long flame travel.**
- **No waterwall headers to slow the circulation or complicate cleaning. Furnace tubes are continuous from drum to drum. There are no handholes to maintain.**
- **Heavy all-welded structural steel base distributes weight over a large floor area. No special foundation is needed.**

Bros "P" Boilers are compact, self-contained, pressurized furnace units with capacities of 10,000 to 100,000 lbs. steam per hour. Standard design capacities are 200 and 250 psig but similar boilers for higher pressures and temperatures can also be supplied.

For illustrations, features, drawings, specifications and complete performance data, see your nearest Bros Representative . . . or write

POWER DIVISION

(BROS)

BROS *Incorporated*

1057 Tenth Avenue S. E., Minneapolis 14, Minnesota

EQUIPMENT DEVELOPMENTS

Continued

Vent for Hydronic Systems Operates on Pressures to 30 Psi

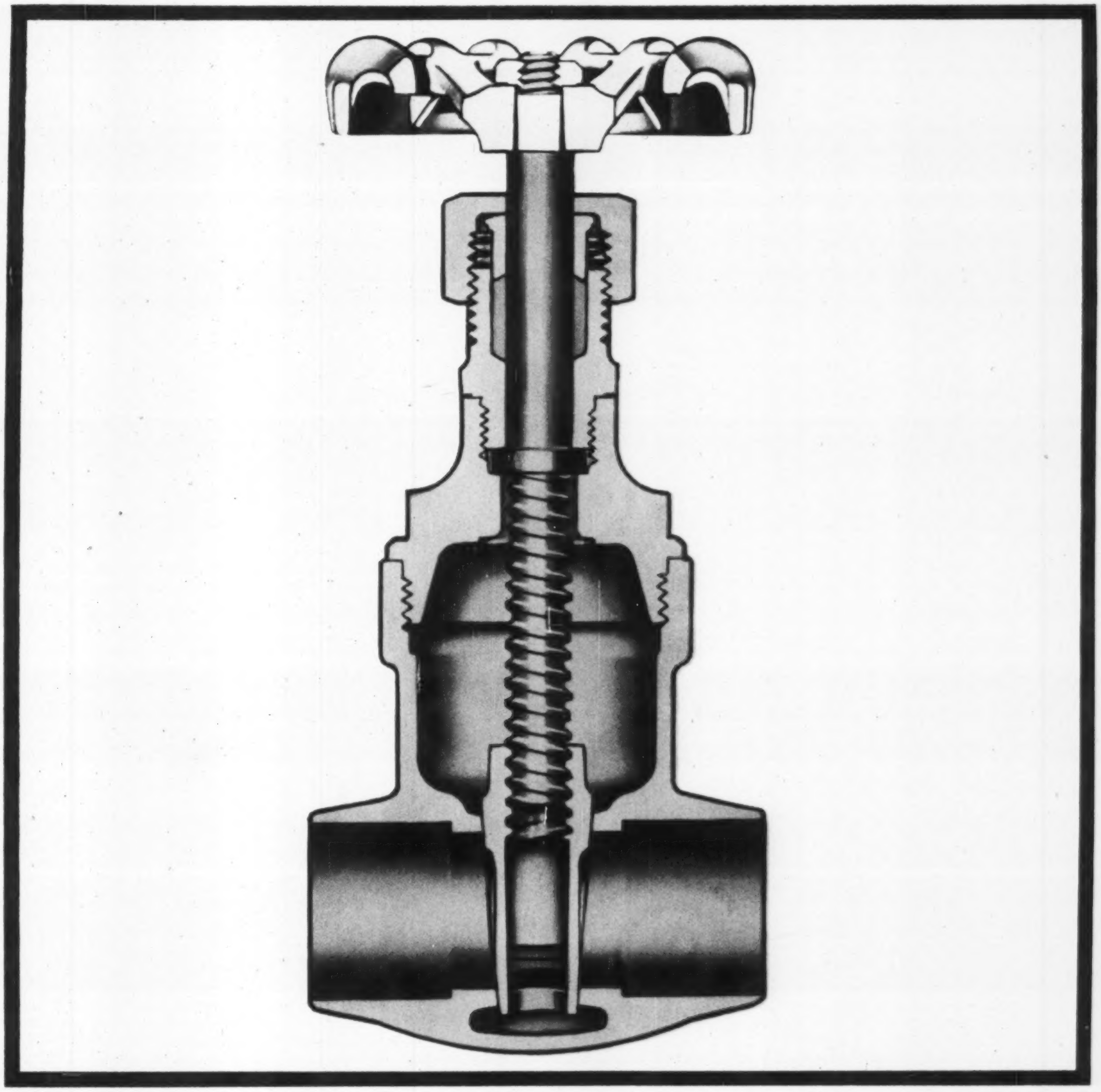
Designed for vertical mounting on hot water systems such as radiators, baseboards, convectors, and small unit heaters; also used for chilled water cooling systems. Features brass construction, is float actuated, with stainless pin seating in Neoprene "O" ring. Furnished with a compression overflow connector for ¼ in. OD tubing. — *The Keeney Mfg. Co., Main St., Newington 11, Conn.*

Gas-Fired Unit Heaters Have Up To 250,000 Btuh Input

Available in 10 basic sizes ranging in heating capacity from 25,000 to 250,000 Btu per hr input. Use natural, manufactured, mixed, and LP gases, including LP gas-air mixtures. Automatically controlled through a room thermostat. Feature die-formed heavy-gage furniture steel casings; aluminized steel heat exchanger tubes; drilled, raised-port cast iron burners; and venturi mixing tubes. — *American-Standard Industrial Div., Detroit 32, Mich.*

Pipe Saddles Provide for Positive Vapor Sealing

Provide positive vapor sealing and insulation, vibration control, and corrosion resistance. Suitable for temperatures from 0 to 400 F. Gives up to 90 percent vibration efficiency. Inner surfaces are treated to minimize friction when rotating pipe for welding. All steel surfaces of the saddle and matching hanger are coated with plastic to prevent corrosion. — *Insul-Coustic Corp., 42-23 54th Rd., Maspeth 78, N.Y.*



Crane expands line...adds 125-pound bronze solder-joint gate valves

Here are valves that can really stand line strain and internal pressure.

Their cylindrical body shape—basically the same used in Crane's high pressure steel valves—distributes loads uniformly, reinforces seats against disc wedging action. These valves stay tight, open and close easily, need little maintenance.

Ample thread engagement between stem and bonnet aligns stem accurately for easy operation, minimum wear. Wedge discs are fully guided and carefully machined. The valve may be repacked when wide open and under pressure. All-purpose, molded graphite-asbestos packing provides a lasting seal.

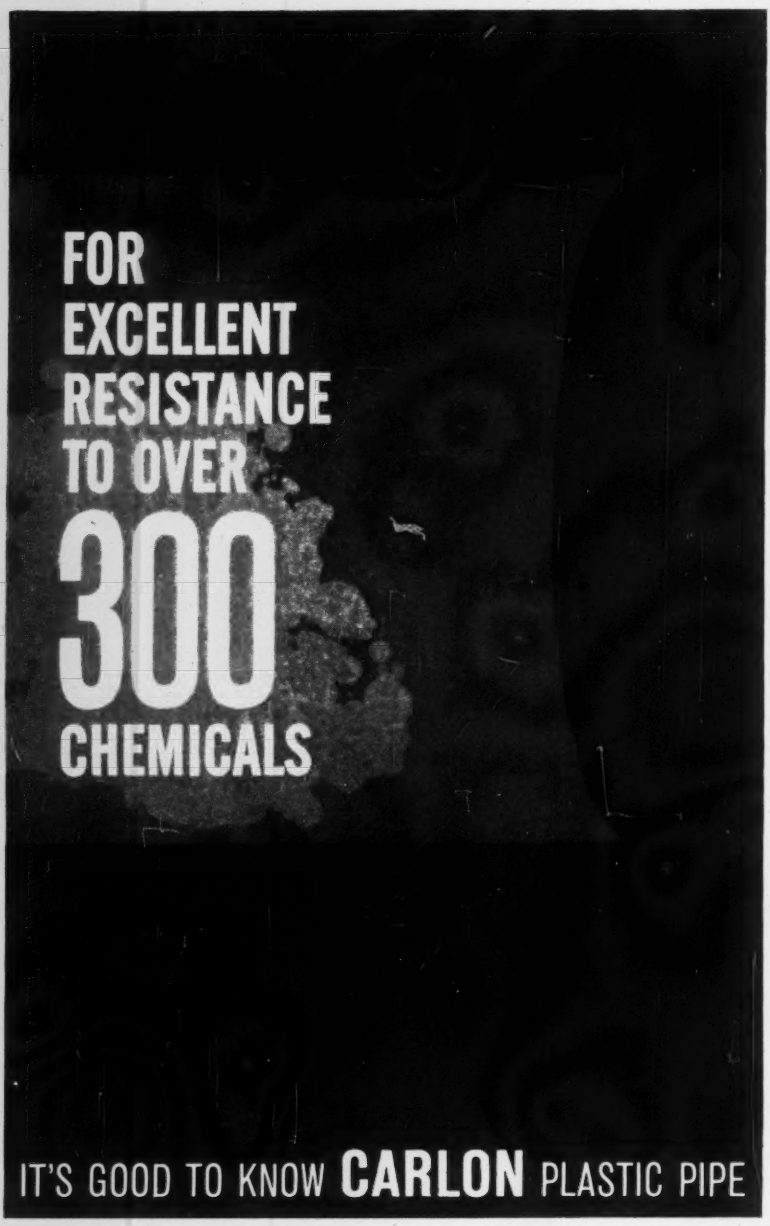
Other features: self-locking nut on comfort-grip hand-wheel; solder-joint bronze body (ASTM B62); ends that meet ASA Standard B16.18; sizes ⅜" to 3" with rising stem (Cat. No. 1334) and non-rising stem (Cat. No. 1324); both meet MSS Standard Practice SP-37.

For more information call your Crane distributor. Or write Crane Co., Dept. X, Industrial Products Group, 4100 S. Kedzie Ave., Chicago 32, Ill. In Canada: Crane Ltd., 1170 Beaver Hall Square, Montreal, Quebec.

AT THE
HEART
OF HOME AND
INDUSTRY

CRANE

VALVES • PIPING • PUMPS
PLUMBING • HEATING • AIR CONDITIONING
WATER TREATMENT
ELECTRONIC CONTROLS • FITTINGS



To help you make major pipe savings . . . Carlon's new Plastic Pipe Fact-pak. Includes chemical names, solution-strengths, operating temperatures and pressures. *Write for yours.*

KNOW THE FIRST NAME IN PLASTIC PIPE
CARLON

CARLON PRODUCTS CORPORATION
Box 133 — Aurora, Ohio — Dept. HP-3
Please send me the new Plastic Pipe Fact-pak.

NAME____________________
TITLE____________________
COMPANY____________________
ADDRESS____________________
CITY____________STATE__________

EQUIPMENT DEVELOPMENTS

Continued

Liquid Level Gages Available In 38 Styles and Sizes

Styles range from flush-mounted, press-fit porthole windows (with or without reflector back, with or without oil line) to column-type units which show oil level at a glance—to dome-type gages which enable reading from both side and front. Available with glass or plastic windows. Glass is recommended for applications of 50 psi and up to 300 F; plastic windows are suitable for 10 psi and up to 100 F, or 2 psi and up to 160 F. — *Gits Bros. Mfg. Co.*, 1866 *S. Kilburn Ave., Chicago, Ill.*

Core Drills Use Water and Abrasives for Masonry Drilling

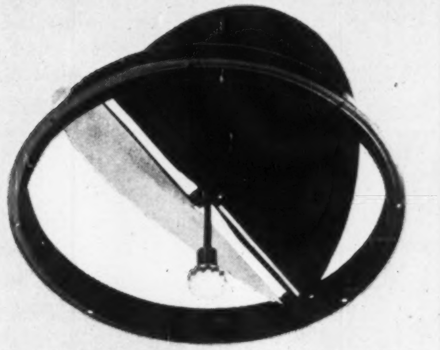
Drills grind holes from ¼ to 6 in. OD in reinforced concrete and other hard materials. Abrasive used is silicon carbide. Suited for vertical drilling only. Ball bearing 1 hp electric motor operates at 220/440 v, three phase, 60 cycle, 1750 rpm. Other specifications available. Gasoline engine drive is available also. — *The Howe-Simpson Co.*, 136 *E. Gay St., Columbus* 15, *Ohio.*

Integral Cylinder Valve Is Self Regulating

Operates without external power source or control system. Suited for nuclear control and stop valves, ultra-high pressure stop valves, flow control, over and under pressure relief, pressure reducing, and back pressure control. Handles a wide range of fluids including high viscosity liquids. Resistant to abrasion and erosion. Features straight-through, non-turbulent flow, and self-purging action. — *General Kinetics Corp.*, 197 *S. Van Brunt St., Englewood, N.J.*

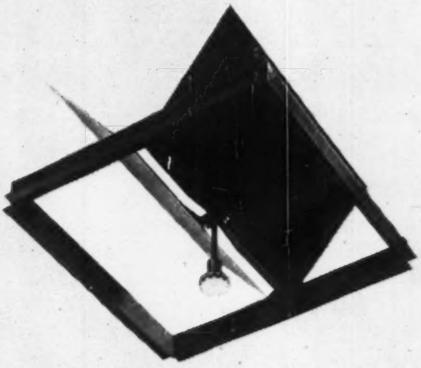
CREATES A REVELATION in The Development of The SUPREME No. 1500 ROUND and No. 2500 SQUARE CEILING DIFFUSERS-KNOB-OPERATED Bi-Valve DAMPERS

BETTER Than The BEST and COST LESS

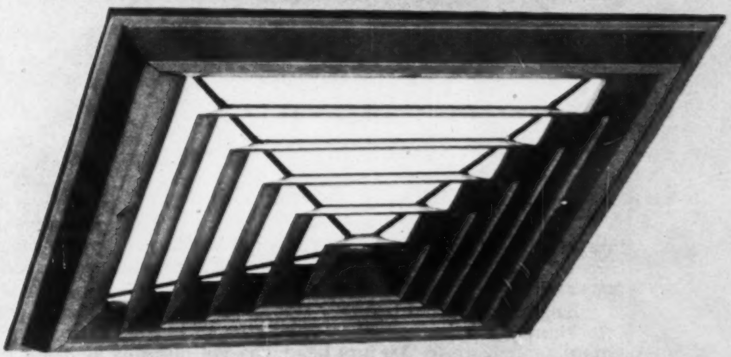


No. 1800 ROUND BI-VALVE CEILING DAMPER KNOB-OPERATED With Removable Knob

No. 1500 U.S ROUND STEP-DOWN CEILING DIFFUSER Also Furnished in No. 1501 FLUSH-TYPE Style SUITABLE For The FINEST JOBS—Yet MOST COMPETITIVE



No. 2800 SQUARE BI-VALVE CEILING DAMPER KNOB-OPERATED Detachable Knob



No. 2500 U.S. SQUARE STEP-DOWN CEILING DIFFUSER Also Furnished in No. 2501 FLUSH-TYPE Style Designed For The FINEST SYSTEMS—Still Most COMPETITIVE

SPECIFY and INSIST on Nos. 1500 and 2500 CEILING DIFFUSERS The BEST For LESS.

SHOWING REAR VIEW of No. 500 ROUND CEILING DIFFUSER with DAMPER

No. 500 SERIES
U.S. ROUND CEILING DIFFUSERS
A STAMPED LOW-COST LINE of ROUND CEILING DIFFUSERS
With No. 800 Round Bi-Valve Dampers

SHOWING The No. 500 ROUND CEILING DIFFUSER and SCREW-DRIVER Operation of Damper Adjustment

ECONOMIC BEAUTY For COMMERCIAL and RESIDENTIAL SYSTEMS

Member

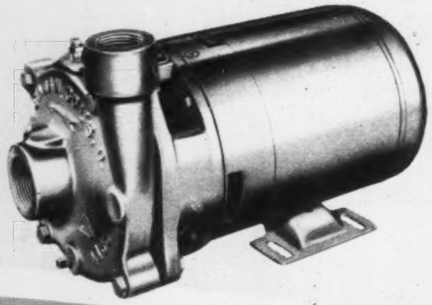
INDOOR COMFORT

Completely described in Catalog "A"—Write for your copy.

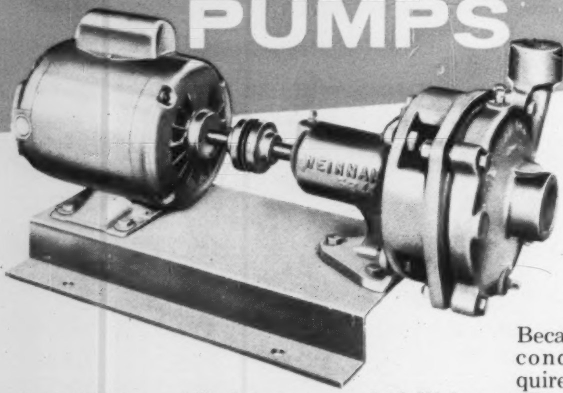
UNITED STATES REGISTER COMPANY

BATTLE CREEK, MICHIGAN
MINNEAPOLIS • KANSAS CITY • ALBANY

where performance counts...



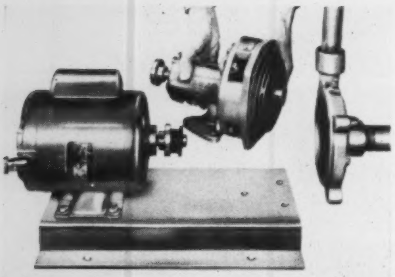
count on WEINMAN PUMPS



Because efficient air conditioning requires fast circulation of hot or chilled water, you find Weinman Type AC and AE General Service Unipumps among specified products for both new construction and old building replacement.

Engineers recognize the Weinman Unipump as the versatile "workhorse" of the industry. Available in output ratings up to 260 g.p.m. against up to 200 foot head, the Unipump is ideal for pressure boosting, moving hot or chilled water and many other general purpose pumping needs. Compact but rugged, it fits into a small area yet delivers the same 24-hour, maintenance-free service you expect and get from every Weinman Pump.

Other standards of the air conditioning industry are Weinman Types ACB and AEB Single Stage, End Suction Pumps with output ratings to 240 g.p.m., up to 200 foot head. Designed for efficient, dependable circulation of hot and chilled water and pressure boosting, these pumps give years of maintenance-free service in addition to initial economy.



Routine servicing is fast and easy. Pumping unit can be disassembled without breaking pipe connections or disturbing motor. Bearing bracket is removed from casing by taking out a few bolts. Seals are replaced without disconnecting casing from pipe line.

Whatever your pumping needs . . . you'll get the best solution with a job-fitted Weinman Pump . . . consult your Weinman Pump Specialist. He's listed in the Yellow Pages.

THE WEINMAN PUMP MFG. CO.
290 SPRUCE STREET COLUMBUS 15, OHIO
CENTRIFUGAL SPECIALISTS

EQUIPMENT DEVELOPMENTS

Continued

Baseboard Diffuser Features Small Size, Large Free Area

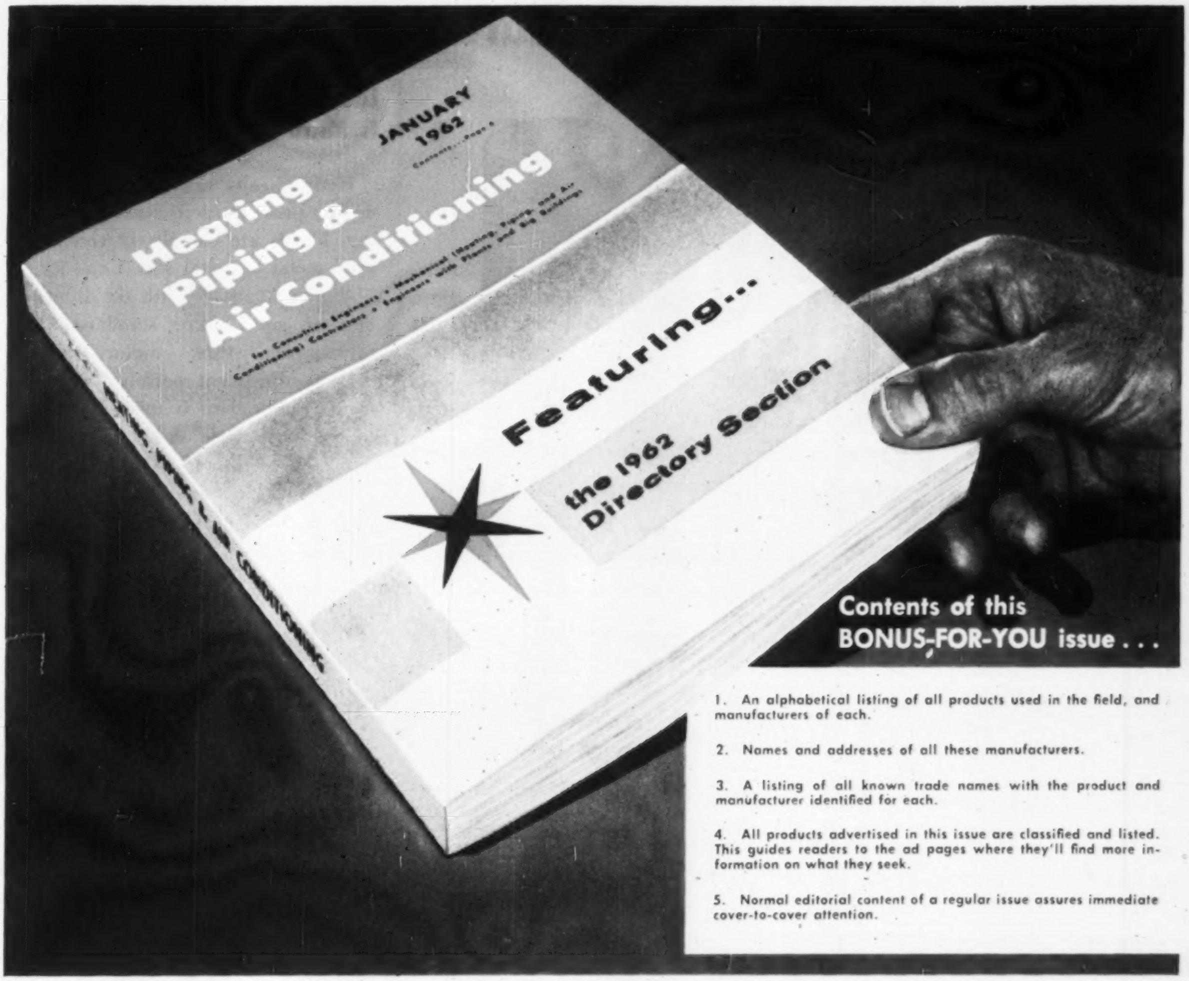
Only 15 in. wide, but has an available 38 sq in. of free area. Adjustable fins are pre-set to blanket up to 13 ft of wall with a wide, fan-shaped pattern. Diffuser face can be removed and replaced any time, making installation possible on either subfloor or finished floor, against the wall or plastered to it. Adjustable stop on the damper opening allows system to be balanced at the face. A matching return air grille without damper is also available. Described in bulletin 307-AC. — *Air Control Products, Inc., Coopersville, Mich.*

Quick Seal Caps for Male Flare Connections

Provide finger-tight sealing of 1/4 and 3/8 in. male flare connections. Feature replaceable rubber gaskets. — *Madden Brass Products Co., P. O. Box 444, Aurora, Ill.*

Butterfly Valves Offered In Manual or Automatic Models

Suitable for control of either air or gas flow up to 5 psi pressure, and with capacities to 20,000 cfh natural gas. Either manual or automatic valves are available in seven pipe sizes from 1 through 4 in. A 90 deg closing valve allows synchronization with shutters using suitable linkage. Upper and lower limits are set by stop screws regardless of motor stroke. Designed for use with Minneapolis-Honeywell "M 204" or "M 931" motors. All sizes are UL approved. — *Mid-Continent Metal Products Co., 2717 N. Greenview Ave., Chicago 14, Ill.*


JANUARY 1962
Heating Piping & Air Conditioning
Featuring...
the 1962 Directory Section
HEATING, PIPING & AIR CONDITIONING

Contents of this BONUS-FOR-YOU issue . . .

1. An alphabetical listing of all products used in the field, and manufacturers of each.
2. Names and addresses of all these manufacturers.
3. A listing of all known trade names with the product and manufacturer identified for each.
4. All products advertised in this issue are classified and listed. This guides readers to the ad pages where they'll find more information on what they seek.
5. Normal editorial content of a regular issue assures immediate cover-to-cover attention.

Be There . . . .

When they're ready to specify or buy

The Directory Section is the acknowledged reference work in the Industrial-Big Building field since 1934

Nowhere will your advertising dollar go farther . . . accomplish more! This is an issue that is a right-at-hand reference for the engineers and contractors you must reach. (In a survey of these *all paid* subscribers, 96% report they keep it throughout the year, 75% refer specifically to its advertising pages.)

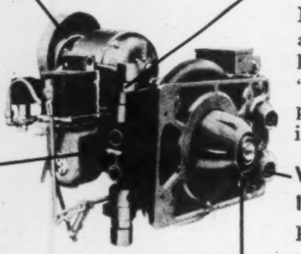
No wonder nearly 300 advertisers appear each year! Make sure you too will profit from this all-in-one January issue with a Directory Section and regular editorial content. Start off 1962 impressively by using extra space for extra emphasis on your entire line. Regular space rates apply, December 10 closing date. KEENEY PUBLISHING CO., 6 N. Michigan, Chicago 2.

these ENTERPRISE features

—are YOURS for

BIGGER BURNER SALES

—AND HIGH CUSTOMER SATISFACTION!



V-BELT DRIVE—EXCLUSIVELY

ENTERPRISE pioneered V-Belt drive for Horizontal Rotary Oil Burners. For 15 years they have been used *exclusively*, for greater efficiency, flexibility and economy!

"MEASURED-RATE" METERING PUMP

Provides for *exact* delivery of the *proper* quantity of oil to the burner — regardless of changes in temperature and viscosity. Another ENTERPRISE first!

LEAK-PROOF HINGE DESIGN

New burner hinge does away with troublesome, leaky packing glands. "O" rings provide for positive, long-life sealing at this critical point!

VENTURI-TYPE IGNITER

Preferred for automatic starting, the ENTERPRISE igniter produces a clean, torch-like flame that eliminates carbonizing, provides failure-proof ignition.

"ANGLE-VANE" AIR NOZZLE

Provides full flame pattern control and efficiency regardless of firebox size and shape!

QUALITY PLUS ENTERPRISE SERVICE —THE RIGHT COMBINATION FOR CONTINUED SUCCESS

ENTERPRISE delivers the "plus" factors that ring up sales, profits and satisfied customers—the key to continued success for ENTERPRISE distributors and dealers. Now is the time to find out about ENTERPRISE—the profit line in commercial and industrial burners. Write today for information.

The Choice of Heating Experts for Dependability

ENTERPRISE
BURNER DIVISION
A DIVISION OF GENERAL METALS CORPORATION

1444 WASHINGTON AVENUE, HUNTINGTON 4, WEST VIRGINIA

DISTRIBUTORS IN PRINCIPAL CITIES THROUGHOUT THE U. S. AND CANADA

Laboratory Feed Pump Is Micro-Regulating

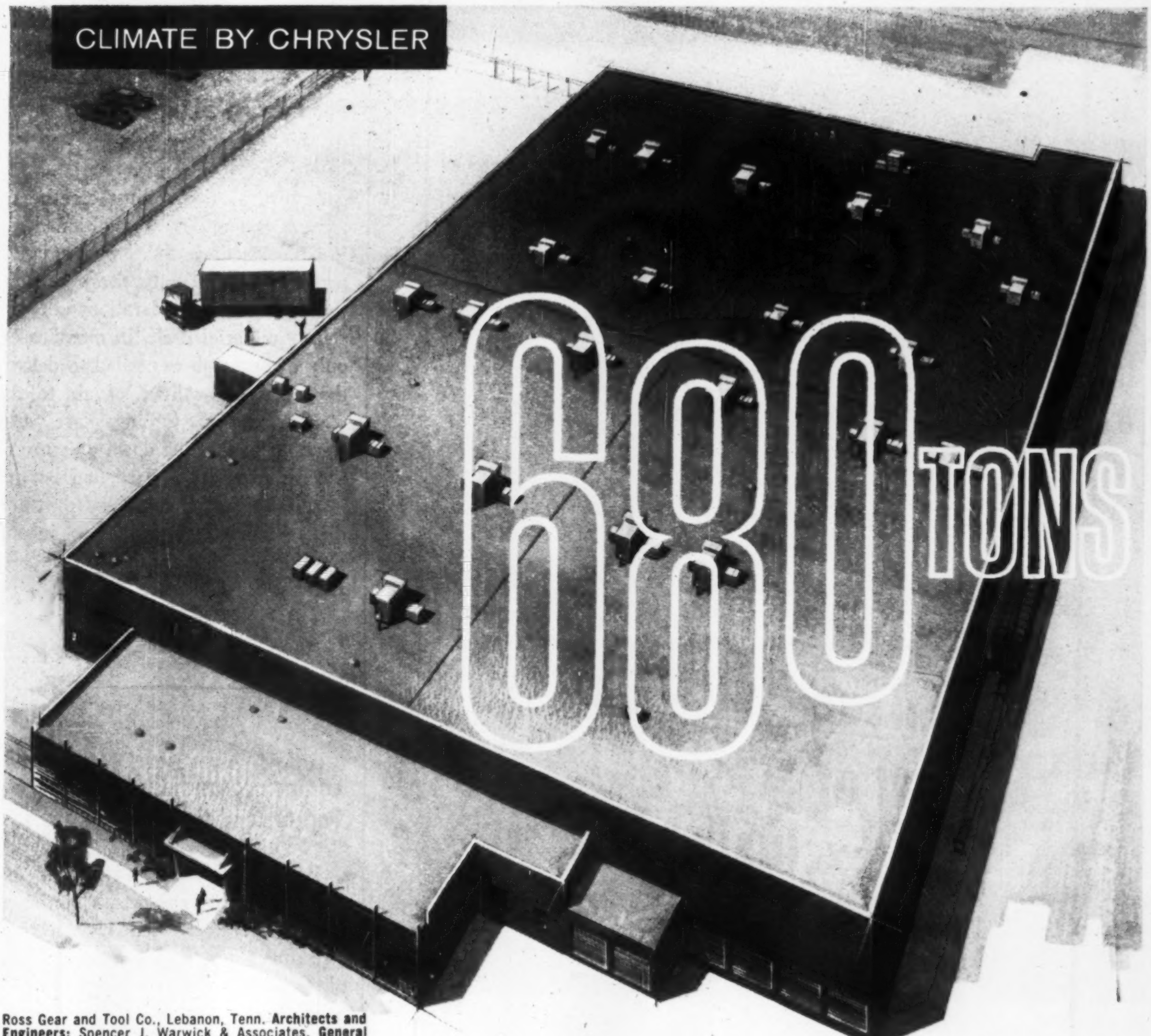
Hydraulically actuated diaphragm design provides zero leakage pumping. Fluids are completely contained by a metal to metal seal. Capacity is 2½ gph. Available with six different plunger sizes, three standard gear ratios, and three motor speeds. Stroke adjustment permits low flow rates to less than 5 ml per hr. All wetted parts made of Type 316 stainless steel. "Monel," "Inconel," and "Hastelloy" are also available. Motors are explosion-proof. — *Whitey Research Tool Co.,* 5525 *Marshall St., Oakland* 8, *Calif.*

Portable Heater Delivers 150,000 Btuh

Circulating warm air heater can be used indoors unvented. Weighs 80 lb, and operates on 115 v a-c line. An automatic thermostat control is optional. — *Master Vibrator Co.,* 1752 *Stanley Ave., Dayton* 1, *Ohio.*

Twin Disc Valve Has Positive Seating, Absolute Shut-Off

Designed around a swivel principle which permits the discs to individually conform to seat faces even with severe pipe strain or distortion due to temperature swing. Made of steel, and are available in sizes from 2 in. up in all pressure classes. Discs can be changed without removing the valve from the line. They are interchangeable with solid wedges, and can be reversed for wear compensation. — *The Chapman Valve Mfg. Co.,* 203 *Hampshire St., Indian Orchard, Mass.*



Ross Gear and Tool Co., Lebanon, Tenn. **Architects and Engineers:** Spencer J. Warwick & Associates. **General Contractor:** Anderson and Gore. **Mechanical Contractor:** Central Air Conditioning & Heating, Inc.

680 tons of Chrysler Air Conditioning on the roof save 1100 sq. ft. of valuable floor space inside

Sprouting from the roof of this new plant for Ross Gear and Tool Company are 22 Chrysler 30-ton packaged air conditioning units. Together with two Chrysler packaged liquid chillers and four split-system units, they provide the cooling (785 tons of it!) for almost five acres of manufacturing and office space.

By putting 680 tons of Chrysler Air Conditioning *on* the roof, instead of *under* it, the company freed 1100 sq. ft. of valuable floor space for other jobs. And by installing these units zone-by-zone during construction, the company saved money by starting operations in part of the building while the rest was being completed.

The cooling load is spread over 28 different Chrysler units, ranging from a 4-ton condensing unit to a 45-ton chiller. Thus, varying departmental load requirements can be handled with ease. There is no fixed operating cost, as there would be with a conventional single-unit installation.

Whether your job calls for air-cooled or water-cooled equipment . . . packaged units or chillers . . . you'll find the complete Chrysler line has the exact unit you need. For complete data, or the technical cooperation of a Chrysler Engineer, write today.

CHRYSLER
AIRTEMP
A Division of Chrysler Corporation
Dept. CD-111 Dayton 4, Ohio

DART
"Note the True Ball Joint ...that's a DART Exclusive"

Yes, Dart Unions fit tighter and last longer because their two bronze seats are precision ground to a true ball joint. You get a drop-tight connection without straining arm, wrench or union. What's more, a Dart uncouples just as easily. Ask your supplier.

QUICK FACTS

- Extra wide bronze seats resist pitting and corrosion.
- Nut and body of air-refined, high test malleable iron are practically unbreakable
- Heavy shoulders can withstand the toughest wrench abuse
- Each Dart is individually vacuum-tested

DART UNIONS *Products of* **DART UNION COMPANY** PROVIDENCE 5, R.I.

GENERAL
SALES
AGENT

THE **Fairbanks** COMPANY
393 LAFAYETTE STREET, NEW YORK 3, NEW YORK
BRANCHES: NEW YORK 3
PITTSBURGH 22 • BOSTON 10 • ROME, GEORGIA

AVAILABLE THROUGH YOUR LOCAL DISTRIBUTOR

EQUIPMENT DEVELOPMENTS

Continued

Acoustical Ceiling Serves As Air Diffusion System

Acoustical tile ceiling creating a plenum space allows conditioned air to flow directly into the room at equal pressure and velocity through thousands of tiny perforations in the ceiling material itself. In many cases, only a duct stub is needed to deliver the necessary volume of air to the plenum space. Ceilings are self-cleaning in that the down pressure of the air provides a perpetual barrier against the accumulation of dust and dirt. Absorbs sound and is incombustible. — *Armstrong Cork Co., W. Liberty St., Lancaster, Pa.*

Contactors and Relays For Electric Heating

Four contactors and relays feature wiping contacts, laminated frame operators, and high contact pressure. Quiet operation makes them applicable for use in schools where time-clock-operated contactors and relays control banks of heaters. Rated at 30 amp, 250 v, a-c, and may be applied continuously at full rating, open or enclosed, with conservative temperature rises. Described in publication No. 703. — *Automatic Switch Co., Florham Park, N.J.*

Radiant Tube Heaters for Moderate to Heavy Loads

Industrial and commercial type units available in 1500, 2000, 2500, and 3000 w models, all for 240 v service. — *Sun-Heat, Inc., Electric Heat Div. of Insto-Gas Corp., 998 E. Woodbridge Ave., Detroit 7, Mich.*

SKIDMORE CLOSE-COUPLED CCVS PUMP

This new pump combines the latest features in centrifugal pump design with a minimum space requirements. It is built in a capacity range from 500 to 10,000 sq.ft. E.D.R., discharge-pressures from 20 to 40 lbs. The CCVS pump is available in three single unit capacities.

Featuring—mechanical shaft seal

Eliminates all leakage from pump shaft . . . keeps floor clean and dry. Pump is self-priming.

dependable performance

No close clearance . . . efficiency maintained. Especially designed for handling hot condensate.

quiet operation

Features of the CCVS vertical pump design eliminates excessive noise. Can be installed on floor level or in pit.

NEW! improved
TYPE CCVS
close-coupled design

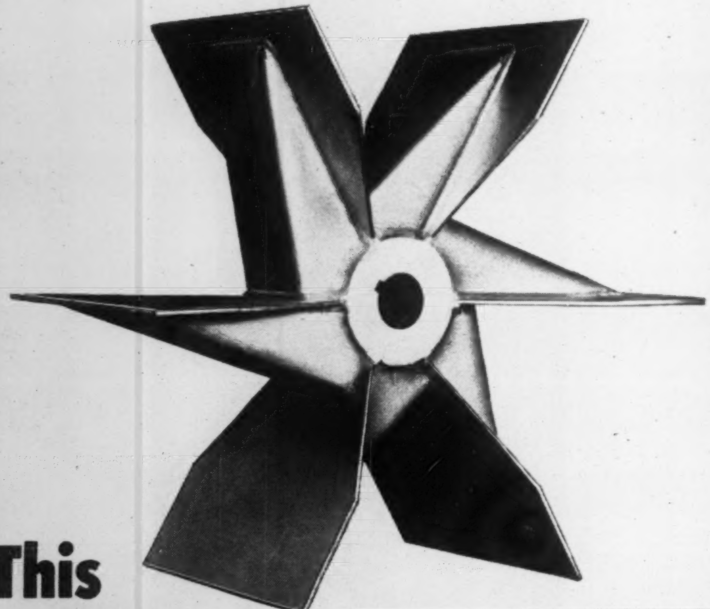
Send for your copy of bulletin No. 21-C which fully describes the new, improved Skidmore "CCVS" condensate pump and complete engineering data.

Here are the answers to— your Heating Pump Problems

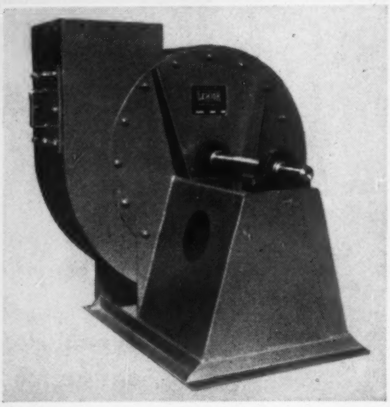
Skidmore pumps have set a standard of performance and dependability through continual research and development since 1921.

SKIDMORE PUMPS

SKIDMORE CORPORATION, ST. JOSEPH, MICHIGAN



This WHEEL



MAKES LEHIGH
I. E. INDUSTRIAL FANS
IDEAL FOR TOUGH
INDUSTRIAL EXHAUST
APPLICATIONS

Handles dust-laden air and gases, paper shavings and the like without clogging

Lehigh Industrial I.E. Fans . . . featuring heavy duty, unique channel construction, all-welded mild steel wheels of the long shaving design . . . solve difficult exhaust problems because of their non-clogging characteristics. They incorporate a universal housing, which permits rotation and discharge to be modified to facilitate variable field conditions.

A complete range of sizes is available in both 70° to 250°F and 251° to 600°F construction. All standard drive arrangements are available and will be furnished according to your specifications.

Rugged, air-tight construction: the fan housing is welded on the inside with a continuous fillet weld. This provides gas-and air-tight housing with joints of maximum strength.

Standard, self-aligning ball-bearing pillow blocks . . . grease lubricated . . . are featured on all Lehigh Industrial I.E. Fans.

Optional accessories include an inspection door, inlet and outlet flange, heavy duty housing construction, and drain plug.

Get detailed information on how Lehigh I.E. Industrial Fans can solve your industrial exhaust problems with dependable non-clogging performance. Your Lehigh Representative will be happy to supply you with full details. Or, if you choose, write directly to us for Bulletin L-5:

"See Chemical Engineering Catalog for details and specifications".

2172
LF-2

LEHIGH FAN & BLOWER DIVISION
FULLER COMPANY, CATASAUQUA 1, Pa.
Subsidiary of General American Transportation Corporation

TRADE
LEHIGH
MARK

EQUIPMENT DEVELOPMENTS
Continued

Diaphragm Valves Feature Nylon Seats and Solder Tube Extensions

Solder connection valves incorporate a nickel-silver insert as part of the tubing extension to cut heat transfer. Valve has two diaphragms: beryllium copper diaphragm is used to give higher resistance to stem wear; a lower diaphragm of stainless steel protects the upper assembly against corrosion. Available in various tube sizes with angle or two-way flare, female pipe, or solder connections. — *Imperial-Eastman Corp., 6300 W. Howard St., Chicago 48, Ill.*

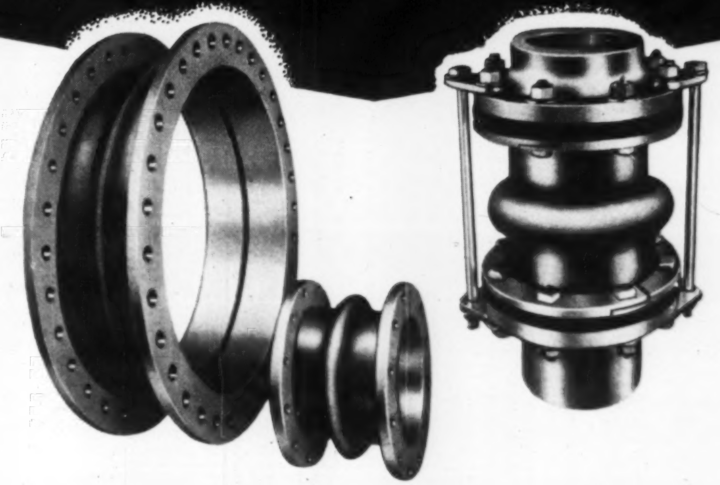
"Teflon" Slotted O-Rings Fit Standard AN Grooves

Style "9593" can replace rubber O-rings without altering groove size. For use with non-flammable hydraulic fluids, solvents, acids, and other fluids. Described in bulletin AD-157. — *Garlock, Inc., Palmyra, N.Y.*

Electric Furnaces for Small Commercial Installations

Two models available with capacities of 33,000 and 66,000 Btu per hr. Both utilize duct work. Designed for horizontal, vertical, or counterflow operation. Contain a three-speed, direct drive blower. Space is provided for a "slide-in" cooling coil. Original blower and blower motor are adequate for the added cooling. In a vertical position, furnaces are 29½ in. wide, 19½ in. deep, and 48⅛ in. high. — *Chrysler Airtemp Div., Chrysler Corp., 1600 Webster St., Dayton 4, Ohio.*

R/M Rubber Expansion Joints and Pipe Solve Piping Stress and Vibration Problems



R/M Rubber Expansion Joints *absorb* pipe movement. They respond to the slightest pressure . . . preventing stress and strain on pipe and fittings that can cause major trouble in ventilating and air conditioning systems. R/M Rubber Joints also *insulate* system components against destructive vibration and noise. Where space is limited or equipment is operated above rated capacity, R/M Rubber Expansion Joints compensate for misalignment due to stress loading. They are available in a wide range of natural and synthetic rubber types for use with gases, fluids or semi-fluids over a temperature range to 200° F.

Condor Flexible Rubber Pipe is ideal for pipe lines subject to noise, vibration, electrolysis, corrosion, abrasion or taking backbends. It will outlast iron or steel—eliminate leaky joints at bends. Let an R/M Distributor discuss with you the advantages of R/M Rubber Expansion Joints, Condor Flexible Rubber Pipe and other R/M rubber products for your heating and cooling applications. Write for Bulletin M685.

R/M POLY-V® DRIVE

Single, Parallel V-Ribbed Belt

- MORE POWER—LESS SPACE
- CONSTANT SPEED RATIO
- ELIMINATES MULTIPLE V-BELT "MATCHING" PROBLEMS
- MAINTAINS GROOVE SHAPE
- LESS BELT AND SHEAVE WEAR
- LESS INVENTORY (2 cross sections instead of 5)

CONVERT TO POLY-V and BE SURE!

CONDOR V-BELTS

For Heavy Industrial Multiple Belt Units

- 40% MORE H.P. AT STANDARD V-BELT PRICE
- PRECISION MADE
- SMOOTHEST RUNNING V-BELTS MADE
- MORE GRIP, LESS SLIP
- LONGER, TROUBLE-FREE SERVICE
- LOWER DRIVE COSTS

NEW R/M CX V-BELT*

For Light Duty Drives

- EXTREMELY QUIET . . . VIBRATION-FREE
- ONLY FULLY-MOLDED, FULLY-JACKETED LUGGED V-BELT
- FOR SMALL PULLEYS
- FLEXIBLE, STRONG, RUGGED
- OUTLASTS OTHERS UP TO 8 TO 1
- NO FLEX-CRACKING
- HOLDS SHAPE AND EFFECTIVE LENGTH WITHOUT STRETCH

*Made for original equipment. Patented.

RAYBESTOS-MANHATTAN, INC.

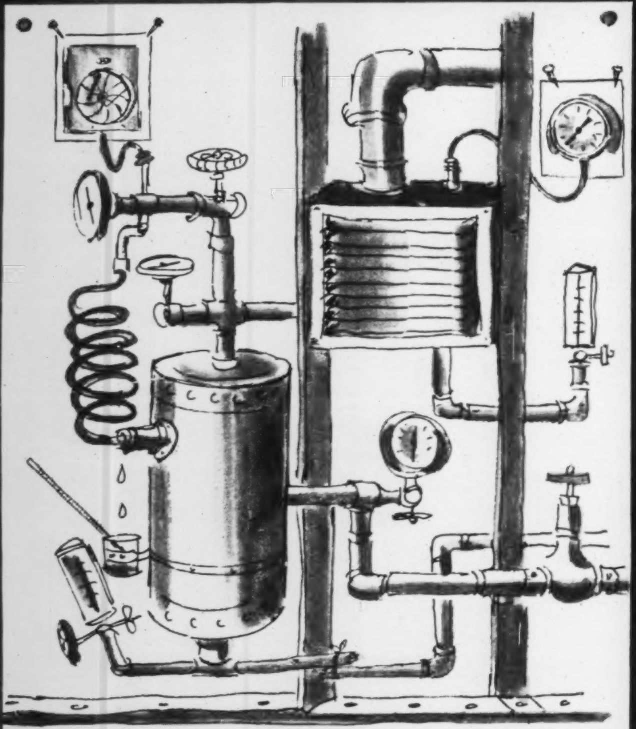
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

RM

RM1005

ENGINEERED
RUBBER
PRODUCTS
. . . MORE USE
PER DOLLAR

SEARCHING FOR A
"SPECIAL"________?



DOLLARS TO DOUGHNUTS
IT'S STANDARD AT WEKSLER!

Why the confidence? We have manufactured literally *MILLIONS* of different types of instruments for measuring and recording temperature, pressure, humidity and time-of-operation. More than likely, the special you're looking for has been produced by *Weksler*. At worst, your problem will prove routine for our engineers.

Save hours, money and a lot of headaches by consulting us *first*. Other manufacturer's *"Specials"* are probably *Standard* with Weksler.

WRITE FOR NEW SPECIFICATION BULLETIN

WEKSLER INSTRUMENTS
"ORIGINATORS OF WORLD RENOWNED ADJUST-ANGLE THERMOMETERS"

WEKSLER INSTRUMENTS
CORPORATION
195 EAST MERRICK ROAD, FREEPORT, L. I., N. Y.
Indicating, Recording, and Controlling Instruments for Temperature, Pressure and Humidity

EQUIPMENT DEVELOPMENTS

Continued

Service Parts Kits For Solenoid Valves

Two kits available for servicing 695 different solenoid valve combinations. Kits contain all removable parts such as coils, plungers, diaphragms, seals, and bolts necessary for service without removing valve from line. Instruction sheets and Allen wrenches also are included. — *Jackes-Evans Mfg. Co., 4427 Geraldine Ave., St. Louis 15, Mo.*

Cutting Wheel Available For Plastic Pipe Applications

Converts firm's "No. 205" tubing cutter into a plastic pipe cutter. For either thin or heavy wall rigid plastic pipe. Capacity for up to 2 in. Schedule 120 plastic pipe (1/4 in. wall thickness). Will not create internal or external burrs. Cut is absolutely perpendicular. Wheel can be stored in handle of tool. — *The Ridge Tool Co., Elyria, Ohio.*

Polyurethane Foam Air Filter Has 15-Year Life Expectancy

Filter media is washable and immediately reuseable without oiling or other treatment. Three-dimensional structure of material has open pores created by the linkage of interconnecting strands. Allows a virtually unrestricted flow of air. Available in a variety of different sizes to meet various pressure drop, efficiency, and dirt capacities. Can be washed without removal from a filter bank. — *Scott Paper Co., Foam Div., Chester, Pa.*

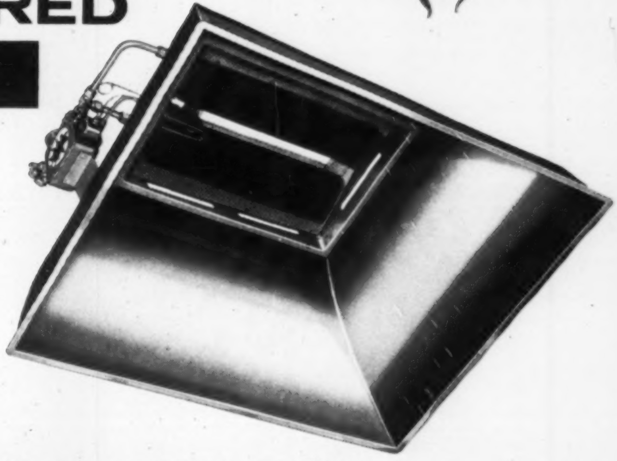
specify

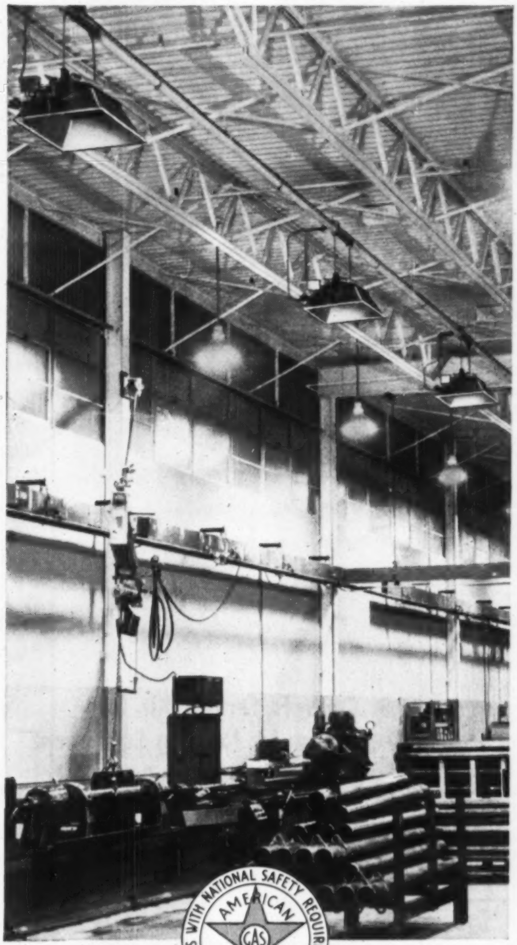
VAN DORN

GAS FIRED

INFRA-RED

AREA HEATERS





ALL METAL CONSTRUCTION

Van Dorn Infra-Red Gas Fired Heaters and Generators are unique in that they utilize a high nickel alloy grid, Inconel metal. The burner plenum is made of grey cast iron while the grid frame is of high quality stainless steel. Special high temperature gaskets give assurance of long life, trouble-free operation. Since there are no moving parts, maintenance costs are kept to a minimum. Substantial savings in fuel costs have been reported from Van Dorn installations throughout the country due to the high Infra-Red radiation efficiency of the Van Dorn Generator design. All Heaters have A.G.A. Approval and carry U.L. Listing.

COMPUTE YOUR FULL B.T.U. REQUIREMENTS BY MEANS OF THIS VAN DORN HEATING CALCULATION METHOD

Compute square footage of exterior walls. Deduct from this figure total square footage of doors and windows arriving at net wall area. Compute square footage of roof. Compute square footage of floor. Compute cube of building to use as multiplier for Infiltration and Air change figures . . . Use the proper "U" factors and temperature maximum with above to determine total BTU heat loss. Consult engineering handbook for "U" factors.

EXAMPLE: A building 100′ x 200′ x 15′ at eaves and 25′ at center peak. 12″ conc. block, conc. floor, metal roof 2″ insul., one air change and 0 to 65° F. temp. range.

Walls 200 x 15 x 2 plus 100 x 20 x 2 = 10,000 sq. ft.

Windows and doors = 1507—Net wall area 8493 x .33 x 65	182,174
Windows 960 x 1.1 x 65	68,640
Doors 547 x .51 x 65	18,133
Roof 52 x 200 x 2 = 20,800 x .13 x 65	175,760
Floor 100 x 200 = 20,000 x .17 x 15 (Max. Temp. less 50)	51,000
***Infiltration** 100 x 200 x 20 = 400,000 x .002 x 65	52,000
Air change 400,000 x .018 x 65	468,000
Total heat loss	1,015,707 BTU

*Note: The figure 20 used in cube of bldg. is avg. ht.

Take 80% of above total or 812,565 and divide by 20,000. This will tell you the number of Van Dorn Single Generator units needed, or 41 in this case. If Double Generator units are to be used, divide by 40,000 and 20 will be required.

COMPLIES WITH NATIONAL SAFETY REQUIREMENTS
AMERICAN GAS ASSOCIATION
APPROVED

Write for Illustrated Brochure

Screen and Plenum—Patents Pending
Casting—Licensee under Schwank Pat. No. 2,870,880

THE VAN DORN IRON WORKS CO. *INFRA-RED DIVISION*
2685 East 79th Street · Cleveland 4, Ohio

Greater strength—less bulk
in
KENNEDY'S Fig. 425
125 lb. S.W.P. Bronze Gate Valves

NEW

125S
200 WOG
KENNEDY

Fig. 425

125S
200 WOG
KENNEDY

Fig. 425SJ

Rising Stem—Inside Screw—Wedge Disc

Kennedy's Fig. 425 now provides the modern cylindrical body design which means greater strength with less bulk than other valves of the same rating. Rugged, wider hex ends blend into the body, prevent distortion, absorb wrench pressure. This is the proven design in the modern valve line for extra service life with less maintenance.

Screwed end valves are for use on steam, water, oil and gas lines. Fig. 425SJ, Solder Joint valves, are for use with types K, L and M copper tubing. With ordinary solder, (50% Lead—50% Tin) temperature must not exceed 250°F. A suitable brazing alloy should be used for higher temperatures.

Fig. 425 valves can be repacked under pressure, eliminating line shut-downs. Simply open valve fully, remove packing nut and repack. These valves conform to Federal Specification WW-V-54, Type II, Class A. They are available in sizes from ⅜" through 3".

For complete details write for Bulletin 613.

KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK
VALVES • PIPE FITTINGS • FIRE HYDRANTS
• OFFICES AND WAREHOUSES IN NEW YORK, CHICAGO, SEATTLE, SAN FRANCISCO, ATLANTA • SALES REPRESENTATIVES IN PRINCIPAL CITIES •
DUCTILE IRON VALVES • CAST IRON VALVES • BRONZE VALVES • INDICATOR POSTS • FIRE HYDRANTS

Hinged Pipe Vise Has Bench Yoke

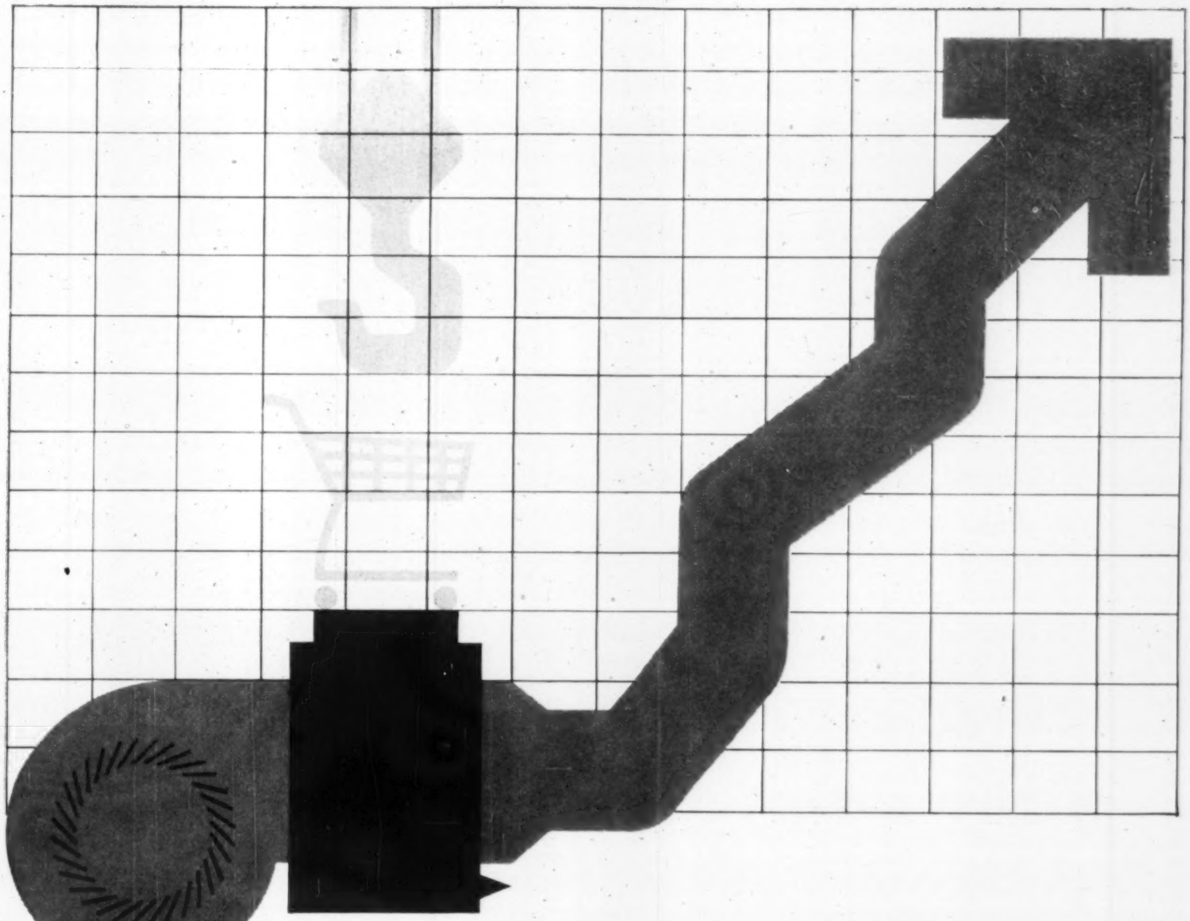
Available in two sizes: No. "15" with a pipe size capacity from 1/8 to 1¼ in., and No. "16" with a capacity from 1/8 to 2 in. Made of shockproof malleable iron parts with extra large, replaceable, hardened steel jaws. The malleable parts are finished in red baked enamel. Machined parts are plated. — *Beaver Pipe Tools, Inc., 310 Dana Ave., Warren, Ohio.*

Large Bore Bits Feature Throw-Away Blades

Holes drilled from 1-¼ to 3-¼ in. in diameter. Will drill through a 2 by 4 in 30 sec when attached to a ½ in. electric drill. Units consist of a drill body to which is attached a screw pilot, cutter blade, and spur blade. Drivers, couplings, and a 6 in. extension are optional equipment. Body is made of high pressure die cast aluminum; cutting blades are high speed steel. — *Time Saver Tools, Inc., 27 East Park Ave., Mundelein, Ill.*

Controls Service Kit for Warm Air Heating Equipment

Kit contains an assortment of six fan switches and three hi-limit controls having appropriate temperature settings for various applications. Includes 13 detachable flanges in three popular varieties. Flanges attach to all controls interchangeably. Individual pieces can be purchased separately. — *Metals & Controls Inc., 34 Forest St., Attleboro, Mass.*



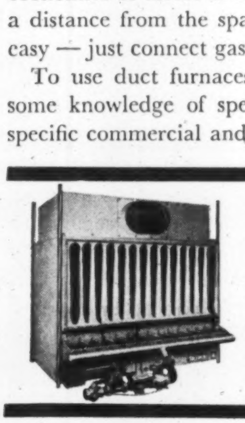
how to use gas-fired duct furnaces most profitably

Free from Reznor: the third in a series of new Reznor Heating Handbooks, "Commercial and Industrial Applications of Duct Furnaces." Duct furnaces offer a relatively new way of heating through air distributing systems. They provide all the economies of direct fired heaters, yet may be located at a distance from the space to be heated. Installation is easy — just connect gas pipe, power, and a vent.

To use duct furnaces most advantageously requires some knowledge of special considerations involved in specific commercial and industrial applications.

That's the purpose of this new handbook, published by Reznor, the world's largest manufacturer of gas unit heaters. It tells about the various ways Reznor duct furnaces can be used for heating or in combination with cooling systems. Also included are illustrations, load calculating data, and practical suggestions to help you get better heating at lower cost.

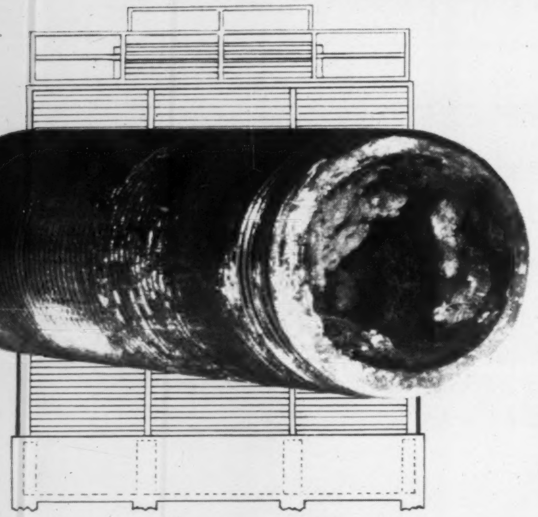
For your copy, mail the coupon to Reznor. And for more information on Reznor heaters, call your distributor or nearby district office listed in the Yellow Pages under "Heaters-Unit".



REZNOR
HEATERS

REZNOR MANUFACTURING COMPANY
Dept. HPA-11, Mercer, Pa.
Send me a copy of "Commercial and Industrial Applications of Duct Furnaces".

name__________ title__________
company__________
address__________
city__________ state__________



COOLING WATER CORROSION MUST BE STOPPED!

Unchecked scale deposit and corrosion in your air conditioning system can cut its life by years . . . increase maintenance and replacement problems several-fold.

Bird-Archer Series 5900 chromate formulations stop severe scaling and corrosion easily, effectively and economically, adjust pH to safe, neutral ranges. In small systems, treatments are added to the circulating water directly from the shipping container through a specially designed Micro-Feeder, eliminating the necessity for manual, daily chemical feeding. For larger units special chemical feed equipment is available.

Write for Bulletin 117 and the name of the Bird-Archer Service Engineer nearest you.

BA-100

LABORATORIES · ENGINEERS · CHEMISTS

BIRD-ARCHER
WATER TREATING CONSULTANTS
The BIRD-ARCHER Company, 4337 N. American St., Phila. 40, Pa. / New York • Chicago
The BIRD-ARCHER CO. of California, 415 Brannan St., San Francisco • Offices in Canada and Mexico

EQUIPMENT DEVELOPMENTS

Continued

Portable Sketch Kit Has Drafting Instrument

Portfolio fold kit includes a drafting instrument with either a 3 by 5 in. or 4 by 6 in. scale, 180 deg protractor, pad of 50 sheets of 8½ by 11 in. drawing paper, and pencil. Kit measures 9½ by 13 by 1½ in. and weighs 1½ lb. — *Draftette Co., P.O. Box 794, Beverly Hills, Calif.*

Fallout Filter Unit Has Three-Stage Filtration

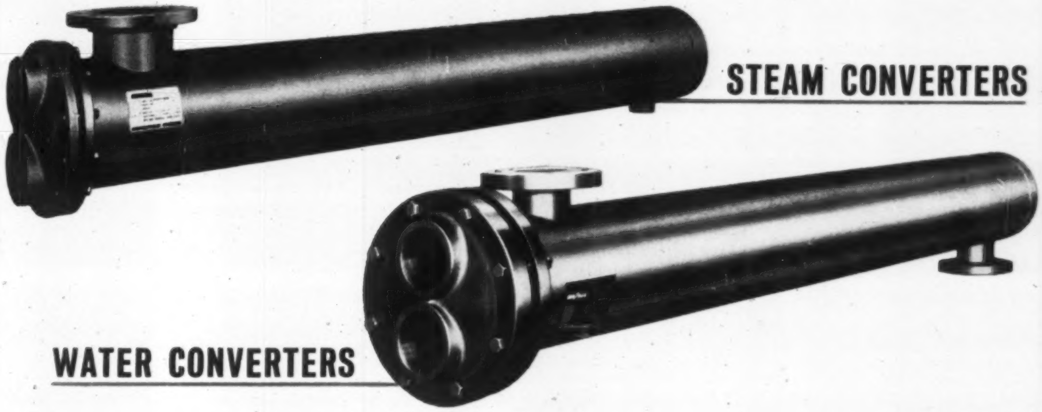
Will remove radioactive dust particles as small as 0.3 microns; removes bacteria up to 99 percent; and the activated charcoal filter will remove toxic gases. Can be placed either inside or outside the underground shelter. Steel frame is 12-5/16 in. square by 14 in. — *Barnebey-Cheney, Cassady at E. Eighth Ave., Columbus 19, Ohio.*

Portable Heaters for Construction Site Uses

Direct-fired units use kerosene, No. 1, or No. 2 fuel oil. Capacities range from 125,000 to 300,000 Btu per hr. Features swirl combustor, built-in thermostat for automatic temperature control, stainless steel combustion chamber and baffle, controls and handle at the "cool" end of the unit, and a fuel tank with 16 hr capacity. — *American Air Filter Co., Inc., Dept. PD, 215 Central Ave., Louisville 8, Ky.*

CONVERTERS

to DUNHAM-BUSH "1 Source . . . 1 Responsibility"


STEAM CONVERTERS
WATER CONVERTERS

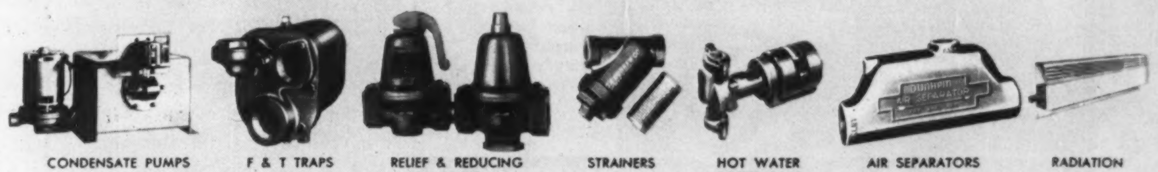
Dunham-Bush converters fulfill a conversion process from steam to water and water to water at reduced temperatures.

Similarly their function illustrates why more consulting engineers, contractors, wholesalers and owners are converted to the advantages of Dunham-Bush "1 Source . . . 1 Responsibility". For Dunham-Bush is the only converter manufacturer **also supplying all other components for the system . . .** on the steam side: traps, strainers, condensate pumps, etc. and on the water side: circulators, hot water accessories and specialities plus radiation.

Both types of converters simplify piping design to effect economies on jobs requiring condensate coolers, domestic water heaters, snow melting applications and radiation water for use in industrial, processing, commercial, office buildings and in other industries.

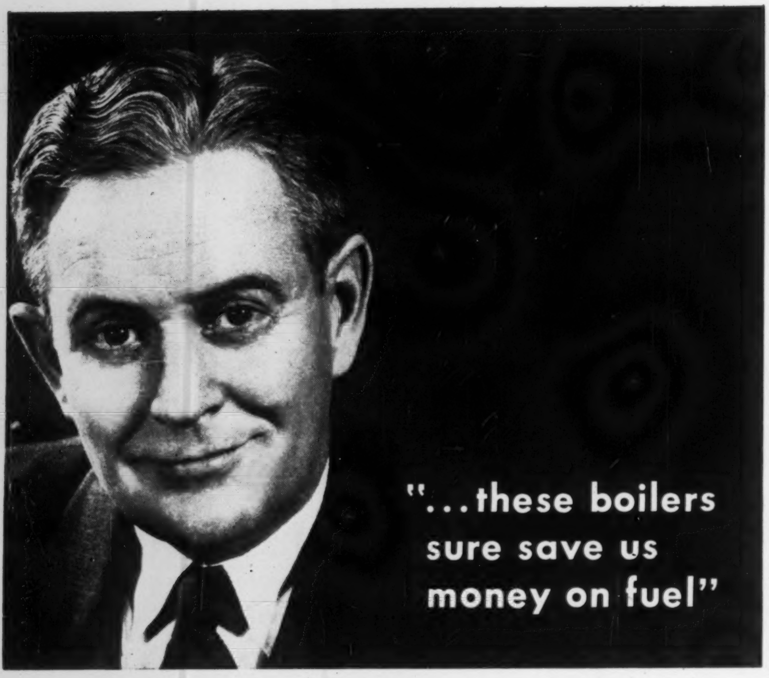
Get full converter details. Write for File Sheets No. 1460 and No. 1463.

PLUS ALL COMPONENTS FOR THE COMPLETE JOB!


CONDENSATE PUMPS
F & T TRAPS
RELIEF & REDUCING VALVES
STRAINERS
HOT WATER CIRCULATORS
AIR SEPARATORS
RADIATION

DUNHAM-BUSH

DUNHAM-BUSH, INC.
WEST HARTFORD 10, CONNECTICUT, U. S. A.
SALES OFFICES LOCATED IN PRINCIPAL CITIES

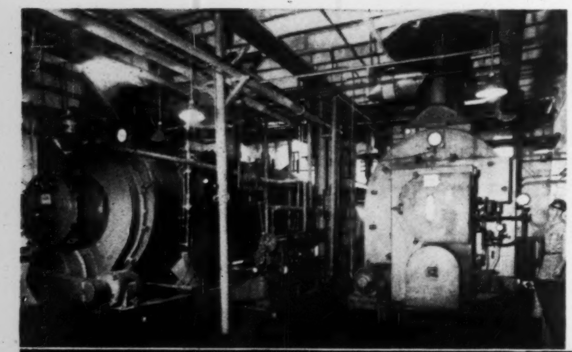

"...these boilers sure save us money on fuel"

Continental

2-PASS

AUTOMATIC BOILERS

Here's why you can be sure of *lower* fuel costs with Continental boilers: Their flue gas temperature is *guaranteed* not to exceed 125°F above the boiler water or steam temperature. High fuel-saving efficiency over the entire life of these boilers is assured by the unequalled heat transfer advantages Continental's exclusive "spinning gas" combustion principle. This spiraling action provides 5 times longer gas travel which assures maximum heat transfer and resultant low stack temperature. With their *guaranteed* 80% minimum efficiency, Continental boilers have an impressive service-proved record for outstanding fuel economy. By keeping fuel costs down, these money-saving boilers enable you to write off their initial cost *faster*. Keep this Continental cost-saving advantage in mind when specifying or buying steam or hot-water boilers for heating or process requirements. Contact your nearby Continental representative or write for latest bulletin of Continental cost-saving features.



These two oil-fired Continental boilers are saving a large meat processing company over $7000 yearly on fuel and maintenance costs.

CONTINENTAL BOILER Division
BOILER ENGINEERING & SUPPLY CO., Inc.
Phoenixville, Pennsylvania
Nationwide Sales and Service in Principal Cities

EQUIPMENT DEVELOPMENTS

Continued

D-c Arc Welders Have Protected Control Panels

Motor generator arc welders have meters and controls protected by a visor. All models have multi-range dual control, with 10 main ranges of welding current and 100 steps of volt-ampere adjustment in each range. Other controls include remote control, polarity switch and motor start-stop-reset buttons. Meters and portable mounting are optional. Rated at 60 percent duty cycle, 200, 300, and 400 amp models are available for either 50 or 60 cycle operation. — *Hobart Brothers Co., Troy, Ohio.*

Heavy-Duty Chain Wrench Available in 15 In. Size

Double acting unit can be used in either direction without removing the wrench from the work. Has 1 beam handle. Electroplated for rust resistance. Capacities from 1/4 to 5 in. pipe. — *Diamond Tool and Horseshoe Co., Duluth 7, Minn.*

Threading Machine Is Portable

Rotary head pipe and bolt threading machine threads 3/8 in. material at 130 rpm. Can thread 1/4 to 1½ in. bolt or 3/8 to 1¼ in. pipe. Dies can be changed in 2 min. Features semi-automatic trip and reset head, full ball bearing construction, knocker-type chuck, and full range vicing. Can be operated on any normal working table without reinforcing or carried wherever production requirements dictate. — *Obear & Sons Sales, Inc., 940 W. Florence Ave., Inglewood 1, Calif.*

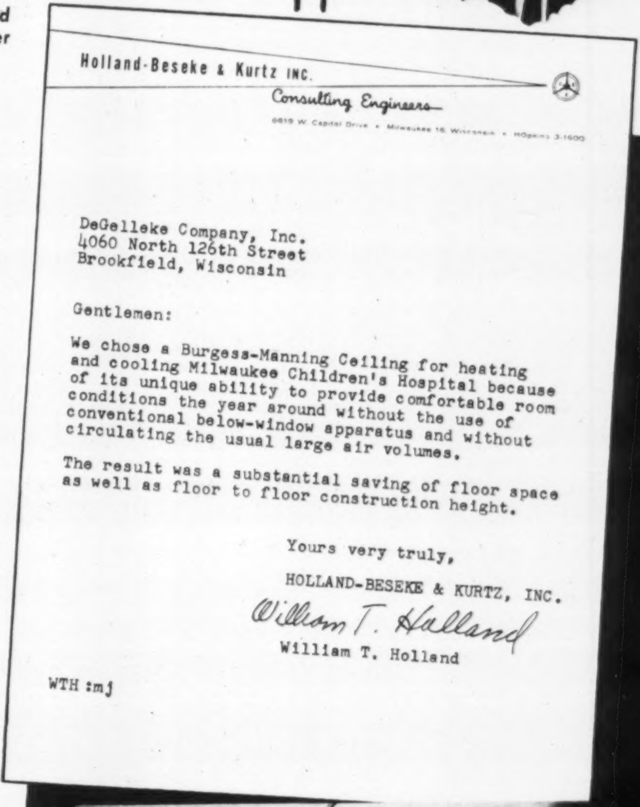
"We chose a Burgess-Manning Ceiling because of its unique ability to provide comfortable room conditions the year around. . ."

—William T. Holland
Consulting Engineer

Mr. Holland's letter confirms . . . and emphasizes . . . what other consulting engineers report on their experience with the Burgess-Manning Radiant Heating, Cooling and Acoustic Ceiling, wherever installed.

For the Burgess-Manning Radiant Ceiling provides the three comfort functions: heating, cooling and acoustic control . . . all combined in one integrated, highly efficient, easily operated unit for superior comfort for hospital patients and staff.

For the architect and consulting engineers, the Burgess-Manning Radiant Ceiling offers unlimited design flexibility in layout, lighting, etc. . . . with *the building better . . . the budget no bigger!*



Holland-Beseke & Kurtz INC.
Consulting Engineers
6619 W. Capitol Drive • Milwaukee 16, Wisconsin • HOpkins 3-1600

DeGelleke Company, Inc.
4060 North 126th Street
Brookfield, Wisconsin

Gentlemen:

We chose a Burgess-Manning Ceiling for heating and cooling Milwaukee Children's Hospital because of its unique ability to provide comfortable room conditions the year around without the use of conventional below-window apparatus and without circulating the usual large air volumes.

The result was a substantial saving of floor space as well as floor to floor construction height.

Yours very truly,

HOLLAND-BESEKE & KURTZ, INC.

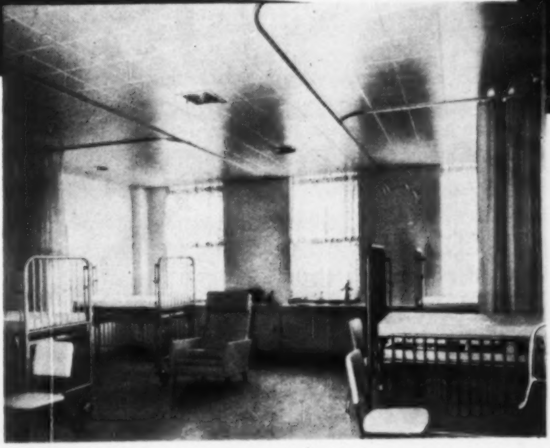
William T. Holland
William T. Holland

WTH :mj

The Burgess-Manning Radiant Ceiling *eliminates* these usual building costs:

- **Recessing for standing radiation, convectors, or other forms of heat distribution.**
- **trenches around perimeter of building, essential with many convective systems.**
- **accommodations for heat distribution devices used with other systems . . . every inch of floor space is clear in buildings with the Burgess-Manning Ceiling.**
- **extra building heights normally required for large air ducts . . . ventilating and air duct requirements are reduced 50% in size by most Burgess-Manning installations.**
- **all air handling equipment, such as blowers, fans, coils, filters, air mixing cabinets, etc., are also reduced in size.**

The desire for comfort and operating economy—not building size—is the all-important consideration for specifying the Burgess-Manning Radiant Heating, Cooling and Acoustic Ceiling.



Burgess-Manning Ceiling Area—31,113 sq. ft.
Architect—Fitzhugh Scott, Jr.
Engineer—Holland-Beseke & Kurtz
Ceiling Contractor—DeGelleke Co., Inc.

Write today for descriptive literature, specifications, etc.—Bulletin 138-3G

Heating Cooling Acoustic

BURGESS-MANNING COMPANY

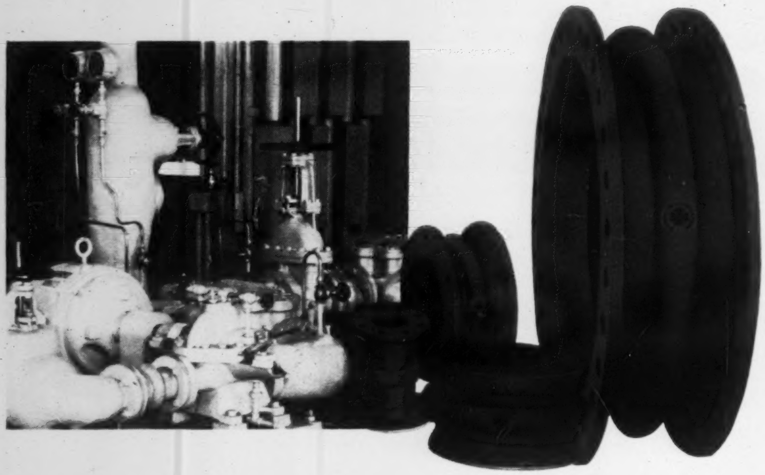
Architectural Products Division

749 East Park Avenue • Libertyville, Illinois

Save ... ON INSTALLATION AND REPLACEMENT COSTS

With

GOODALL Rubber EXPANSION JOINTS



Goodall Rubber Expansion Joints are flexible, durable connections for pipe lines and other equipment handling virtually all fluids and gases under pressure and vacuum, to prevent excess stresses due to expansion and contraction; to counteract vibration; and to insulate against undesirable sound. They can also be designed to overcome misalignment.

EASIER TO INSTALL—on new equipment or as replacements. Light in weight, with short face-to-face dimensions. Metal retaining rings quickly aligned and bolted. No gaskets required.

LONGER SERVICE LIFE—no embrittlement or corrosion. High resistance to abrasive wear.

STYLES, SIZES AND PRESSURES TO MEET ALL REQUIREMENTS

Contact Our Nearest Branch, or Write for Catalog

"If it's GOODALL, it MUST be Good!"

Standard of Quality—Since 1870

HOSE · BELTING · FOOTWEAR · CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL Rubber Company

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES.
IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

RECENT TRADE LITERATURE . . .

Airborne-Particle Monitoring

Two page leaflet describes a programmable instrument for the continuous, unattended size/concentration analysis of airborne particulates. Unit available with or without self-contained dilution facilities. Specifications detail the 15 particle size ranges starting with 0.32 microns; the automatic size-range scanning arrangements; the visual and recorder readouts; and such details as physical and electrical characteristics and prices. — *Royco Instruments, Inc., 440 Olive St., Palo Alto, Calif.*

Fan-Coil Controls

Six page guide covers electric controls for fan-coil units. Features, electrical and installation specifications, and applications for both thermostats and valves are given. Also details advantages of the controls for fan-coil units. Features, *Minneapolis-Honeywell Regulator Co., Commercial Div., 2753 Fourth Ave. South, Minneapolis 8, Minn.*

Valve Sizing

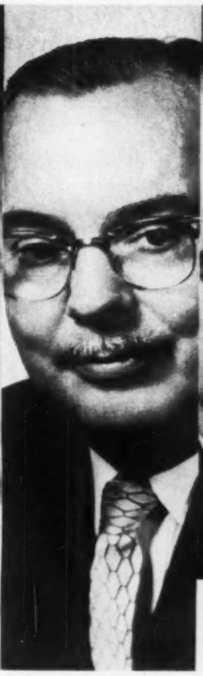
Four page technical paper is an explanation in layman's language that tells exactly what appears in undersized, oversized, and correctly sized pressure reducing applications. Gives a typical example, and points out the dangers of missizing. — *Jordan Valve, 6013 Wiehe Rd., Cincinnati 37, Ohio.*

Pressure Reducing Regulators

Eight page bulletin SM 71 discusses balance, pilot operated, and direct acting valves for pressure reduction, regulation, and maintenance of steam, water, gas, or oil pressure. Presents service data, connecting pipe sizes, construction specifications, and operation details of each valve type. — *Strong, 508 Sandusky St., Conneaut, Ohio.*

SERVICE
Paul Darby, Pres.
RSES

SALES
Bill Tennity, Pres.
WACIA



WHOLESALERS
E. P. Sorensen, Pres.
ARW

CONTRACTORS
Walter McCarty, Pres.
RACCA

MANUFACTURERS
Hy Jarvis, Chairman
ARI Expos. Committee

INDUSTRY
R. K. Serfass, Pres.
ARI

WE'LL ALL BE THERE WILL YOU?

AIR-CONDITIONING AND REFRIGERATION INSTITUTE
ARI

12TH NATIONAL EXPOSITION AIR-CONDITIONING, HEATING & REFRIGERATION INDUSTRY

LOS ANGELES · CALIFORNIA FEB. 12-15 · 1962

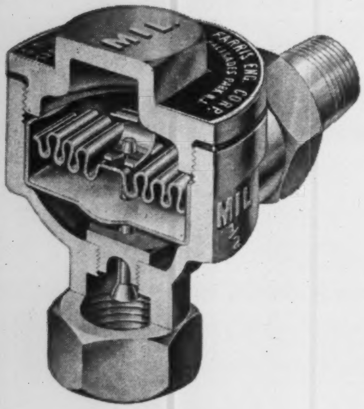
Here's the show you can't afford to miss—the biggest of all ARI Expositions. History-making opportunity to increase sales ... talk to new sources of distribution ... talk to manufacturers who can use your products ... meet contractors and other specifiers ... establish and maintain your brand loyalty among service personnel ... mingle with engineers in every phase of your industry.

This show already has a record number of national exhibitors. You owe it to your company's future in this great industry to exhibit; to yourself to attend in person. ARW, RACCA, RSES, ARI, NWAHACA, AND WACIA will all have a dominant place in this tremendous event. They'll all be there! Will You?

Plan to exhibit now! Contact: George E. Mills, Show Director
1346 Connecticut Avenue, N.W., Washington, D.C. · COlumbia 5-0405

Farris

TYPE 25 RADIATOR STEAM TRAPS



CUT REPLACEMENT

Farris Type 25 Mil Steam Traps outlast ordinary bellows and float traps 10 to 1. Many have been in constant daily service for 15 years without maintenance or repair. Features like these tell why:

- Indestructible stainless steel bi-metallic thermal element
- Unaffected by corrosion, water hammer, fatigue, or rough handling
- Precision-forged bronze construction with stainless steel working parts
- STANDARDIZE . . . 1 size takes the place of 3

BOOST PERFORMANCE

Maximum steam line performance and economy is assured by Mil Steam Traps' unique construction:

- Rapid response to temperature change
- High pressure quality at low pressure cost
- Highest capacity for L.P. heating
- No steam loss—tight shut-off

FARRIS MIL STREAM TRAPS ARE GUARANTEED TWO YEARS

FREE: Information on complete Farris Mil line for pressures from 0-25 psi, 0-65 psi, 0-125 psi, 0-225 psi to 0-300 psi, write for catalog FE-310

Farris® ENGINEERING CORP.
MIL DIVISION
563 Commercial Avenue
Palisades Park, N.J.

RECENT TRADE LITERATURE

Continued

Piping Design Analysis

Four page leaflet explains how the Franklin Institute Laboratories' engineers use the Institute's UNIVAC computing center for piping design and analysis. The service is available to industry for either flexibility analysis or complete design-analysis. — *Franklin Institute Laboratories, 20th and Parkway, Philadelphia 3, Pa.*

Small Unit Heaters

Twenty page catalog 46S 46U 46SE describes three types of small capacity steam and hot water unit heaters. Capacities range from 13,400 to 1,062,000 Btu per hr. Units feature horizontal, vertical, and four-way air discharge patterns. Provides data on steam and hot water ratings, physical dimensions, and electrical and piping diagrams. — *Carrier Corp., Syracuse, N.Y.*

Proportional Controller

Four page instrument section No. 53 describes thermo electronic unit for process control. Features reduced number of controls, only two, for ease of operation. Instrument will not hunt, overshoot; gives "straight line" set point control over wide range with approximately-correct control settings. — *Thermo Electric Co., Inc., Saddle Brook, N.J.*

Compressors and Condensers

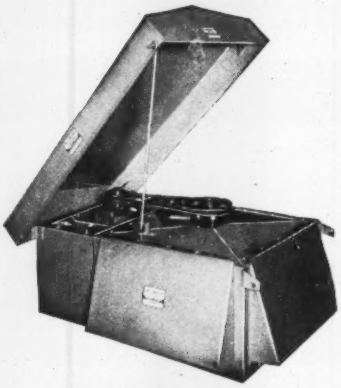
Fifty-eight page application manual No. 789 in looseleaf form covers "Multi-Drive," semi-hermetic, direct drive, and belt drive units from 10 to 100 hp. Contains capacity correction courses, wiring diagrams, vibration isolation and selection tables, capacity and hp curves, and other application data. — *Dunham-Bush Inc., 179 South St., West Hartford 10, Conn.*

AirMpeler

LO-BOY

CENTRIFUGAL ROOF EXHAUSTERS

Enhance the Beauty of Building Skylines



Pats. Pend.

Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

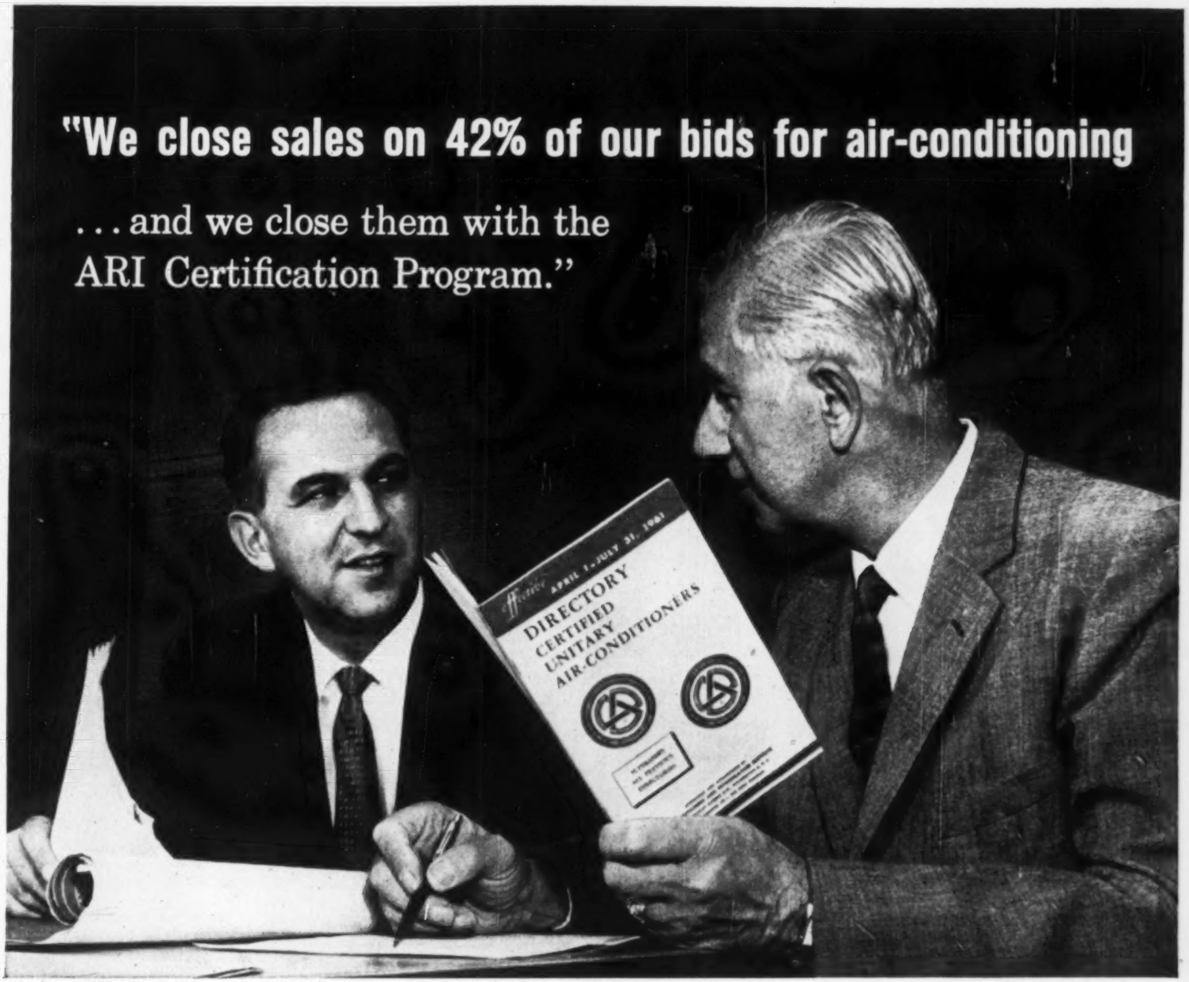
LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- QUALITY ● BEAUTY
- PROVEN PERFORMANCE

Write for bulletin Ha-100 60

AMMERMAN CO., INC.
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.

P.O. Box 182
Stillwater, Minnesota



"We close sales on 42% of our bids for air-conditioning

. . . and we close them with the ARI Certification Program."

"Thanks to the ARI Certification Program we've been getting more than our share of central air-conditioning installations here in the extremely competitive Washington, D.C. market," says George Rosen.*

"Here's how we do it:

"First we advise our prospect to forget about 'horsepower' and 'amperes'. We explain that the *industry-approved* performance standard is based on Btuh. We tell him his best buy will be the unit that gives him the most Btuh for each dollar he spends.

"Then we use the ARI Directory to back up our performance claims for the equipment specified in our bid. We explain how the Certification Program works and point out that the ratings in the Directory are subject to checking at any time by an independent testing laboratory. We emphasize the severity of these tests and how they assure him of satisfactory performance and minimum maintenance expense. The ARI consumer folder, 'How to Buy Central Air Conditioning' is a real help in getting this story across.

"Our firm has a reputation for integrity, but we have profited from the *extra* confidence inspired by the impartial authority of the industry-approved ARI Certification Program. It is often the decisive factor in closing a sale."

Free copies of the ARI Directory and "How to Buy Central Air Conditioning" are yours for the asking. Write to:

THIS UNIT HAS BEEN CERTIFIED AS COMPLYING WITH
AIR-CONDITIONING AIR-CONDITIONING AIR-CONDITIONING ®
ARI STANDARD 210

AIR-CONDITIONING & REFRIGERATION INSTITUTE

Department H-1113 1346 Connecticut Avenue, N.W., Washington 6, D.C.

**Mr. George Rosen is President and General Manager of R & M Air-Conditioning Co., Inc. of Washington, D.C.*

when the heat's on

R-900 Multi-Temp
900,000 BTU/hr. Input

be sure it's

When the job's got to be right . . . at the right price . . . remember Hydrotherm!

Gas heat costs less than oil heat in big jobs (to 3,600,000 BTU/Hr) when you install Hydrotherm's MULTI TEMP hydronic system.

Sequence-fired combustion chambers permit automatic input modulation in accordance with load requirements — no short cycling — no override — built-in standby protection. Factory assembled . . . fits through a 2 ft. 6 in. door.

Easy to install, all cast iron, and guaranteed for 10 years . . . you can't miss with Hydrotherm.

Write for bulletin #HY-F107 and all the facts.

HYDROTHERM MULTI TEMP

HYDROTHERM, INC., DEPT. 13HP, NORTHVALE, NEW JERSEY

RECENT TRADE LITERATURE

Continued

Tubular Products

Thirty-two page bulletin explains the broad scope of applications involving tubular products. Covers such topics as temperature control, steel pipe, how pipe is made, couplings, joints, and fittings. Illustrated with numerous photos, line drawings, and tables. — *Wheeling Steel Corp., Wheeling, W. Va.*

Gas Infra-Red Equipment

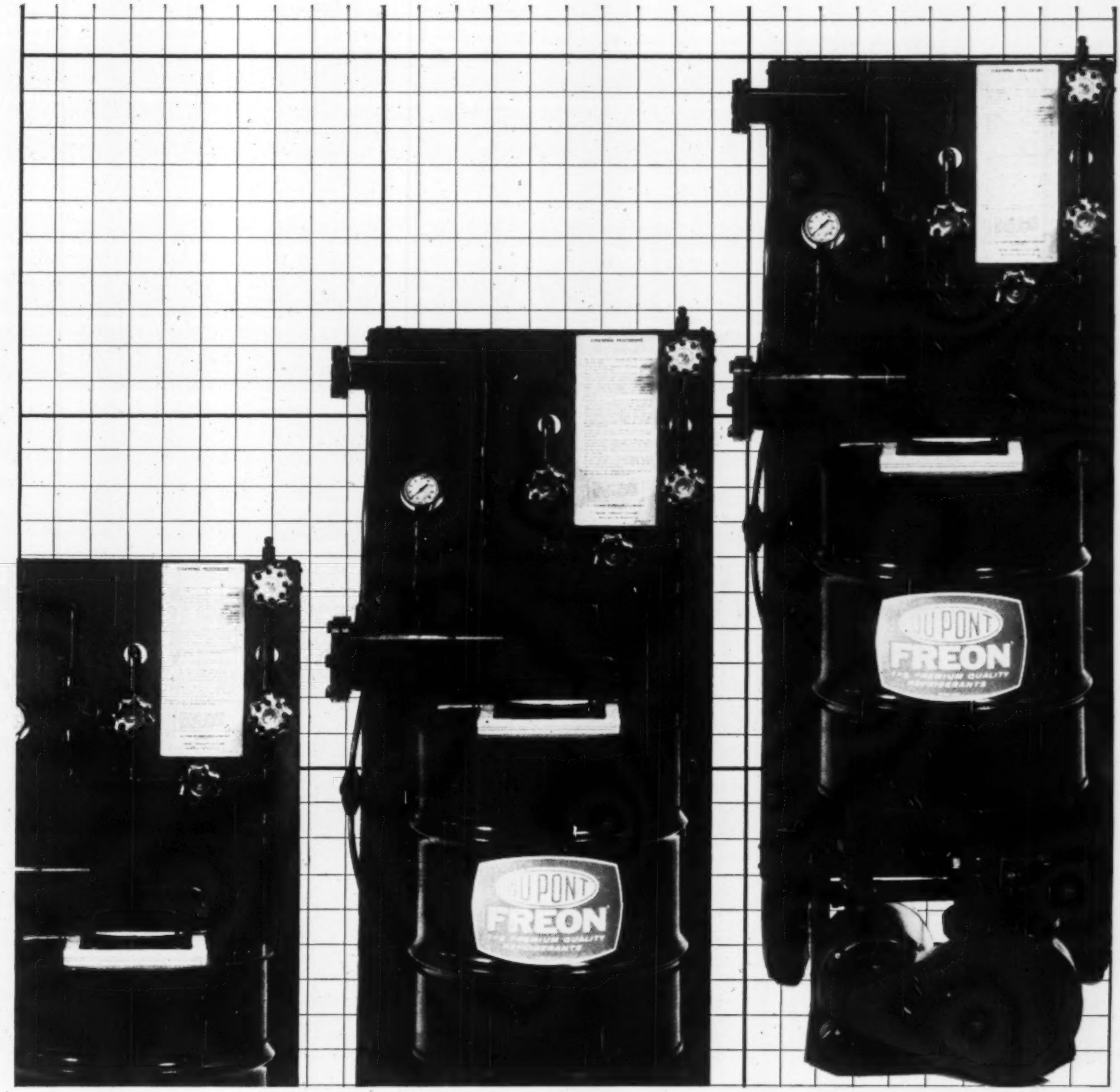
Eight page bulletin 31361 describes application of gas infra-red equipment for pre-heating, moisture removal, paint baking, and curing applications in industrial processes. Discusses the theory and application of infra-red energy. Shows 18 different oven installations. Temperatures of the burners can be controlled between 1000 and 1850 F. — *Hupp Corp., Fannon Products Div., 3000 E. Woodbridge, Detroit 7, Mich.*

Duct Silencers

Two bulletins, B39 and B5 R3, describe unit conforming to the standard specification for air conditioning set forth by the General Services Administration. Gives air flow vs. pressure drop and acoustical performance based on a net insertion loss (acoustic wedge termination, heavy wall duct) test method. Both are illustrated with photos and tables. — *Silence Inc., P.O. Box 21, Farmingdale, N.Y.*

Airfoil Fans

Twelve page bulletin ASQ-102 describes fans available in seven sizes from 8¾ to 18¼ in. in both single and double inlets for operation up to 9 in. static pressure. Contains detailed information on performances, characteristics, and dimensions. Diagrams show mechanical efficiencies. —*Chicago Blower Corp., 9800 Pacific Ave., Franklin Park, Ill.*



RAISE PROFITS

with this new Du Pont power-cleaning unit for burnouts

Call-backs on refrigeration burnout jobs can run up costly hours of non-profit service time. Now, however, you can help eliminate costly call-backs by doing a thorough cleaning job the first time—with a new power-cleaning unit designed by Du Pont. This new unit does the job not by replacement or simple flushing, but by thorough recirculation. It uses Freon-11*, the most effective selective solvent available for oil, sludge, or grease.

Complete burnout cleanup can be accomplished quickly and efficiently in just eight short steps with this practical, mobile unit. And when you recharge the system, you'll find Du Pont's improved lightweight "Zephyr" cylinders make that job a whole lot easier, too.

To increase your profits and improve your reputation for dependable service, use this cleaning unit for burnout jobs. Ask the helpful air conditioning and refrigeration wholesaler near you who sells "Freon" for all details.

FREON® **premium quality REFRIGERANTS**

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING... *THROUGH CHEMISTRY*

*FREON and F- followed by numerals are Du Pont's registered trademarks for its fluorocarbon compounds.

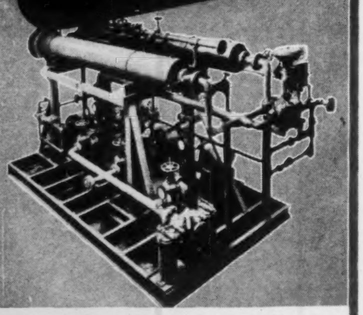
save on installation and maintenance

with

EAGAN

"pre-packaged"

FUEL OIL PUMP and HEATER SETS



Use an Eagan "pre-packaged" fuel oil pump and heater set for the preparation of heavy oil for combustion. You save time and money because units are completely assembled, ready for immediate installation. Only connections to oil and steam supply, burner, by-pass and relief lines have to be made and you avoid the combustion difficulties so often caused by field assembled combinations.

Here are additional benefits Eagan gives you:

- **Generous reserve capacity, at least 50% over peak burner demand, allows for eventual wear and future demand increases.**
- **Maintenance is easy and at a minimum. Parts requiring service are easily accessible.**
- **"Honest", solid construction, excellent engineering assure long life, trouble-free operation.**
- **Compact units save space.**

EAGAN fuel oil pump and heater sets heat to 300° F, pump to 400 psi and have capacities to 3000 gph. Single or duplex units are available for steam or electric drive. Duplex "electro-steam" sets provide for electrical failure by incorporating one steam pump and one electric motor driven pump. Other EAGAN sets can be made to your special requirements.

Write, wire or call for further information or let us bid on your job.

WALTER H. EAGAN CO., INC.
2337 Wallace Street, Phila. 30, Penna.
CEnter 6-2300

Mfrs. of condensate, boiler feed, turbine, centrifugal and proportioning pumps and fuel oil pump and heater sets.

Pump Specialists Since 1920

RECENT TRADE LITERATURE

Continued

Process Control

Eight page bulletin No. 4.20-1 discusses the feeding, weighing, blending, and proportioning equipment for the controlled delivery of liquids and solids in process industries. Involves either a single unit or a fully integrated system. Handles materials from soda ash and industrial alcohols to liquid latex, carbon black, and rocket propellants. Lists industrial systems to which equipment is applicable. Illustrated with photos and schematics of typical process systems. — *B-I-F Industries, P.O. Box 276, Providence 1, R.I.*

Variable Speed Changer

Two bulletins describe units available in five case sizes ranging from 1 to 30 hp. "Vari-Tex" provides stepless speed changes within standard speed ranges of 2 to 1 through 10 to 1 at operating speeds from 1.8 to 4660 rpm. Choice of mechanical, electrical, and pneumatic controls. Four page bulletin 51B9061B features 4, 5, and 6 case sizes. Two page bulletin 51B1042 features sizes 2 and 3. — *Allis-Chalmers Mfg. Co.,* 1171 S. 70*th St., Milwaukee* 1, *Wis.*

Heater Sections

Twelve page bulletin IFB-61 describes heater sections with a face-and-bypass damper system for temperature control. Explains how thermostatically-controlled dampers regulate the proportion of air passing over heated coils or through bypass openings between coils. Illustrated with diagrams, photos, and cutaway drawings. Includes capacity charts, dimension tables, and hookup diagrams. — *L. J. Wing Mfg. Co.,* 140 *Vreeland Mills Rd., Linden, N.J.*

METER STEAM the CONDENSATE WAY

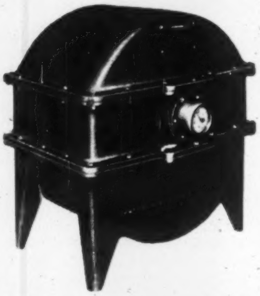
for

Lasting Accuracy
Dependability
Low Maintenance
Long, Long Service

• • •

CADILLAC CONDENSATE METER

Since 1906 it has become the standard for most Central Heating Systems in the U.S.A.



Available in Gravity or Vacuum Types.

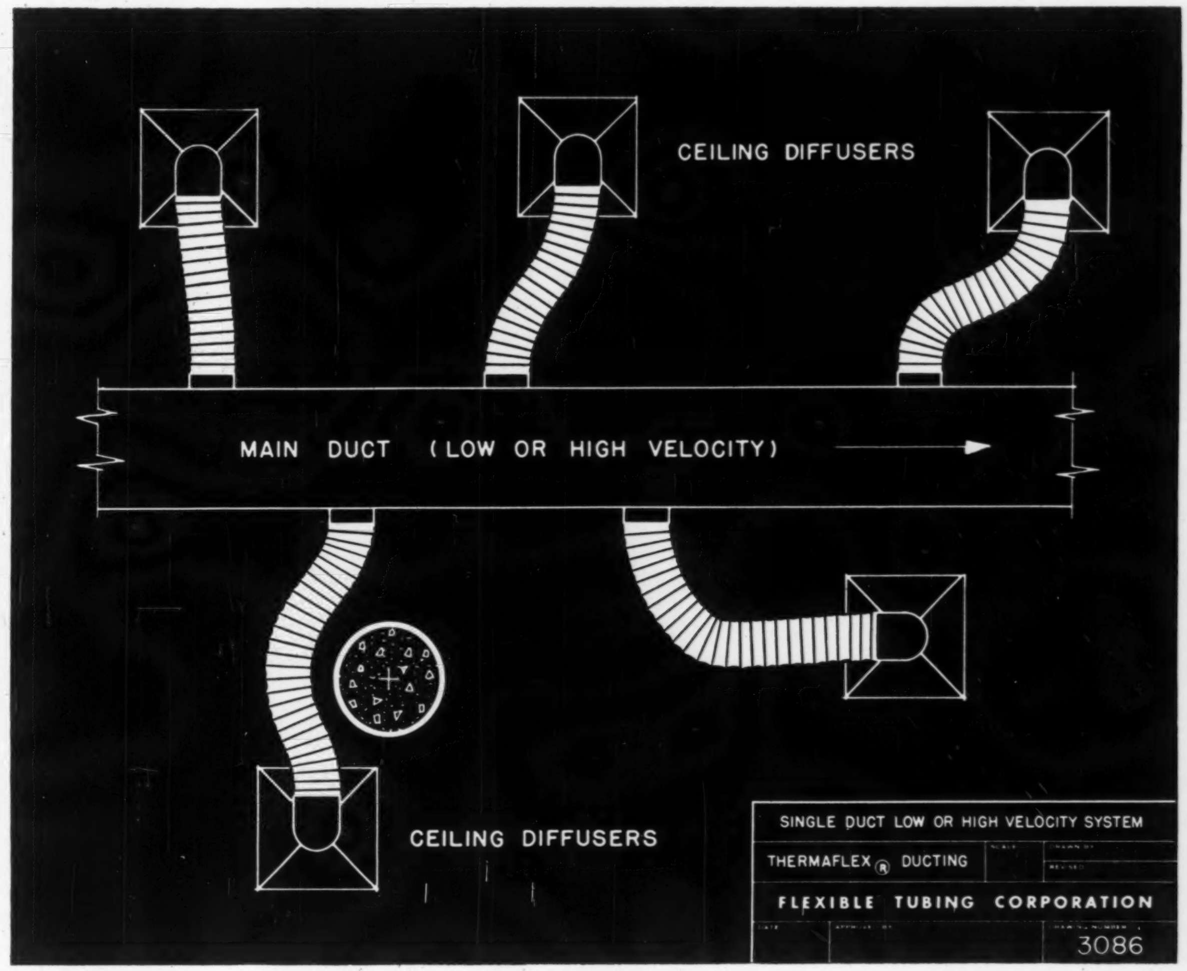
Accurate to within 1% from zero to rated capacity regardless of system pressure.

CADILLAC Meters are used by:

- **Public Utility and Municipal Heating Systems**
- **Shopping Centers**
- **Universities**
- **Institutions with multiple buildings or departments**
- **Industrial steam users with closed systems**

Write for catalog #25 and name of nearest distributor.

CENTRAL STATION STEAM CO.
2912 E. Woodbridge • Detroit 7, Mich.


CEILING DIFFUSERS
MAIN DUCT (LOW OR HIGH VELOCITY)
CEILING DIFFUSERS
SINGLE DUCT LOW OR HIGH VELOCITY SYSTEM
THERMAFLEX® DUCTING
FLEXIBLE TUBING CORPORATION
3086

For single diffuser take-offs...

Flexible Tubing simplifies connections ... gives you greater design flexibility

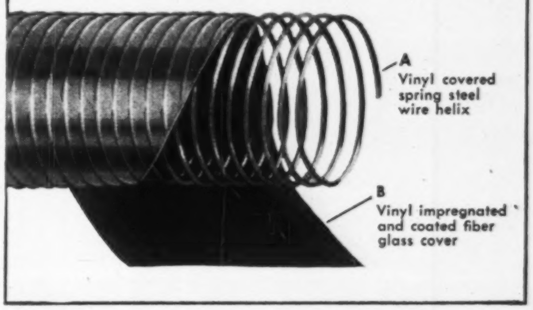
Flexible Tubing is the fast, easy way to connect supply ducts to diffusers in both low- and high-velocity systems.

This highly flexible duct is ideal for connecting individual diffusers directly to main supply ducts in any installation where you have single diffuser take-offs. Flexible Tubing can go over pipes, wires, beams . . . through tight passages . . . even around sharp corners! . . . in gradual, gentle bends with minimum air flow loss.

Moreover, Flexible Tubing reduces noises and vibration . . . corrects for misalignment at points of take-off. It's lightweight, rugged, flameproof, moisture- and abrasion-resistant!

Take advantage of this remarkable product's great flexibility in the next system you design. For complete product data on Underwriters'-approved Thermaflex®, write to Flexible Tubing Corporation, 511 New Whitfield Street, Guilford, Connecticut.

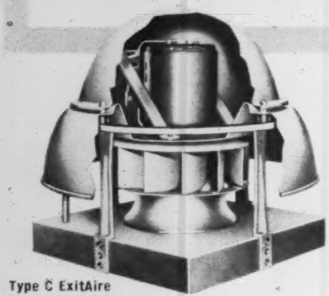
See why THERMAFLEX-ST is so flexible and rugged!


A
Vinyl covered spring steel wire helix
B
Vinyl impregnated and coated fiber glass cover

Flexible Tubing
CORPORATION
GUILFORD, CONNECTICUT
Anaheim (Los Angeles) • Hillside (Chicago)

EFFICIENT VENTILATION AT MODERATE COST!

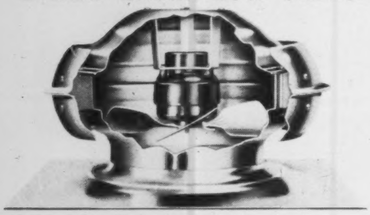
Exit-Aire®
EXHAUSTERS



Type C ExitAire
Power Roof Exhauster

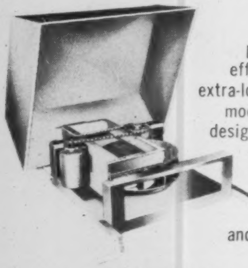
The complete line of low silhouette, round and square models of ExitAire Power Roof and Wall Exhausters and Relief Vents gives you ultra-modern design simplicity combined with features found only in much higher priced competitive units. Certified capacity ratings... U.L. Approved... Approved by CSA (Canada) Testing Laboratories.

2 NEW EXTRA-LOW UNITS



Type VP Power - Type VA Gravity

Low to conform perfectly with today's architectural requirements... compact... highly efficient. Heavy gauge aluminum... sizes 8" to 24". Both Types VP and VA **may be mounted in any position from horizontal to vertical** without the necessity of a curb, thereby reducing installation costs.



Type S unit provides high efficiency in an extra-low silhouette model of square design to conform with the architecture of modern square and rectangular buildings.

MEMBER A.M.C.A.
Send for free catalog of complete ExitAire line.

EXITAIRE CO.
P. O. Box 276, 13650 Vaughn St., Pacoima, Calif.

RECENT TRADE LITERATURE

Continued

Flexible Metal Hose Connectors

Four page bulletin No. 26 gives data on connectors for common vibration, expansion, and misalignment conditions. Includes a section on stock fittings, charts showing specifications and working pressure correction factors, and a detailed section on proper installation and use. Illustrated with photos and tables. — *Atlantic Metal Hose Co., Inc., 308 Dyckman St., New York 34, N.Y.*

Motor Winding Protection

Eight page bulletin F-2034 describes solid-cast encapsulation for the protection of motor windings. Gives the results of tests on the formulation and on completed solid-cast stators. Protects against chemical fumes, heat and cold, dust, water, fog, salt spray, abrasives, repeated and prolonged electrical surges, solvents, acids, caustics, and other conditions. Available on motors up to 125 hp, 1800 rpm. — *U.S. Electrical Motors Inc., P.O. Box 2058 Terminal Annex, Los Angeles 54, Calif.*

Pneumatic Indicating Receiver

Two page data sheet No. A113.1.3-10 covers strip-scale indicating receiver. Can be used as a single unit or gang assembled for either horizontal or vertical mounting. Permits simultaneous indication of coordinated variables. Discusses applications and provides engineering drawings of construction, design, and size. — *The Bristol Co., P.O. Box 1790, Waterbury 20, Conn.*

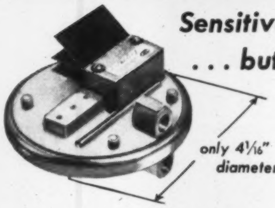
Water Heating Coils

Forty page catalog 404-2 describes the "Type 5 Coil." Contains direct selection tables and information on capacity and air and water pressure drop. Illustrated with photos, graphs, line drawings, and exploded views. — *McQuay, Inc., 1600 Broadway N.E., Minneapolis 13, Minn.*

Dwyer

Differential Pressure Switches for all your low range needs

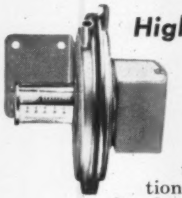
Sensitive ... but small



Compact, low cost, highly sensitive to differential pressures in ranges from 0.15" to 80" water. Holds set point through various total pressures. Virtually unaffected by vibration. Use in any position. *1800 Series.* Write for Bulletin E-40.

High Reliability...

Settings down to 0.05" water



Repetitive accuracy within 1% in pressure ranges too low for conventional switches. Dead band as low as 0.03" water. Visual set point, tamper proof calibration. No drift or hysteresis error. High static pressures. *1630 Series.* Write for Bulletin E-30.

Double Circuit Control with Center Null Area

Dead band spans pressure control range—two micro-switches actuate separate circuits at high and low limits. Ranges from 0.15" to 24" water. *1627 Series.* Write for Bulletin E-20.

Variations For Special Applications

For example—open contact null type switch for controlling reversible blower motors... or for pressures up to 100 PSIG with range of 4" of w.c. differential pressure... engine intake air filter switches... high/low alarm actuation for telephone circuit tie-in... extremely-low-range magnetic double circuit switch for upper/lower environmental limit control.

Give us details of *your* special low-range differential switch requirements. We'll recommend a pressure switch suited to your needs.

F. W. DWYER MFG. CO.
P.O. Box 373-H • Michigan City, Ind.

5-WAY MONEY SAVER

SONOCO
SONOAIRDUCT®
FIBRE DUCT

Sonoco SONOAIRDUCT – the *original* (and still best-selling) Fibre Duct for slab perimeter heating and cooling – saves contractors and owners money five ways!

1. Low initial cost.
2. Cuts installation costs. Lightweight SONOAIRDUCT handles, joins, levels easily, and long lengths mean fewer joints. Can be cut to size with a hand saw.
3. Every piece is usable. SONOAIRDUCT won't chip, crack or break when dropped – no sharp edges either!
4. Job-proven performance dependability . . . protects your reputation and your customer's pocketbook. Meets or exceeds all F.H.A. criteria and test requirements for products in this category.
5. Low operating costs. SONOAIRDUCT'S aluminum foil lining offers a low coefficient of air friction and low heat loss ratio.

Use economical, time-saving Sonoco SONOAIRDUCT Fibre Duct on your next slab perimeter job. Order required lengths or standard 18′ lengths – in 22 sizes from 3″ to 36″ I.D.

FREE INSTALLATION MANUAL

contains latest, detailed, step-by-step installation data for SONOAIRDUCT Fibre Duct. For free copy, send us your name and address on company letterhead.

SONOCO
SONOAIRDUCT
FIBRE DUCT
INSTALLATION INSTRUCTIONS
FOR PERIMETER HEATING AND COOLING SYSTEMS
PERIMETER SYSTEMS

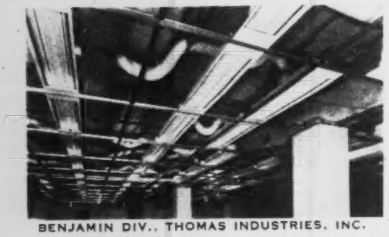
For complete information and prices, write

SONOCO
Construction Products

SONOCO PRODUCTS COMPANY, HARTSVILLE, S. C. • La Puente, Calif. • Fremont, Calif. • Montclair, N. J. • Akron, Indiana • Longview, Texas • Atlanta, Ga. • Brantford, Ont. • Mexico, D. F.

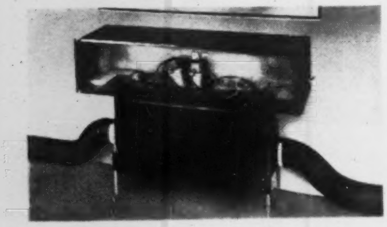
5157

WHICH IS WHICH ?

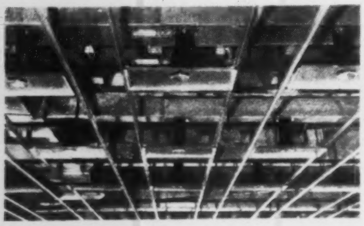


BENJAMIN DIV., THOMAS INDUSTRIES, INC.

1 ☐ HIGH ☐ MEDIUM ☐ LOW VELOCITY



2 ☐ HIGH ☐ MEDIUM ☐ LOW VELOCITY



3 ☐ HIGH ☐ MEDIUM ☐ LOW VELOCITY

ALL THREE USE

WIREMOLD®

AIR DUCT

The most versatile supply duct for air conditioning systems, Wiremold Air Duct also saves time on the job. The result is the lowest installed cost. Send for full information.

Answer: (1) low, (2) high, (3) low.

THE WIREMOLD COMPANY • HARTFORD 10, CONN.

11-1C

WIREMOLD ■ HARTFORD 10, CONN.

Send latest literature.

NAME

COMPANY

ADDRESS

RECENT TRADE LITERATURE

Continued

Stainless Steel Ball Valve

Two page circular 612 describes Type 316 stainless steel ball valve for corrosive fluids, gases, and general corrosive services. Describes valve operation, shows cutaway views, gives pressure ratings, specific design data, dimensions, and applications. — *Lunkenheimer Co., P.O. Box 360, Annex Station, Cincinnati 14, Ohio.*

Pumps

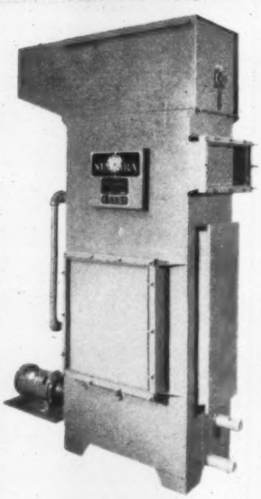
1008 page "Pic-A-Pump" catalog describes entire line of centrifugal axial, and mixed flow pumps. Includes a 64 page yellow reference section carrying data relating to pumps, hydraulic design, and general tables and charts frequently required in the application of moving liquids. Make request on company letterhead. — *Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee 1, Wis.*

Research Services

A 16 by 21 in. technology spectrum chart shows areas of research interest and competence at Battelle Memorial Institute. Hundreds of types of specialized research are grouped together under 10 major areas. Includes biosciences, ceramics, chemical engineering, chemistry, economics, electronics, mechanical engineering, metallurgy, nuclear energy, and physics. — *Battelle Memorial Institute, Publications Office, 505 King Ave., Columbus 1, Ohio.*

Electric Furnace Fume Control

Six page bulletin No. 924 shows how exhaust hood combined with a synthetic-fabric dust collector eliminates electric furnace smoke and fumes. System operates even during oxygen lancing. Photos and sketches show design and application data. — *Pangborn Corp., 400 Pangborn Blvd., Hagerstown, Md.*



The AIR CONDITIONER you can really TRUST FOR ACCURACY

Hundreds of critical processes and testing procedures with hygroscopic materials have proven the NIAGARA "Type A" to be the one conditioner that is truly reliable over long periods.

It performs these duties:

- **Maintains temperature and humidity constant to tolerances of 1° F and 1% R. H.**
- **Changes temperature and humidity as required in a range not afforded by other apparatus.**
- **Furnishes either heating or cooling.**
- **Provides moisture or dryness in any desired proportion to air for Processing.**
- **Cleans, deodorizes and purifies the air.**
- **Assures the air movement desired.**

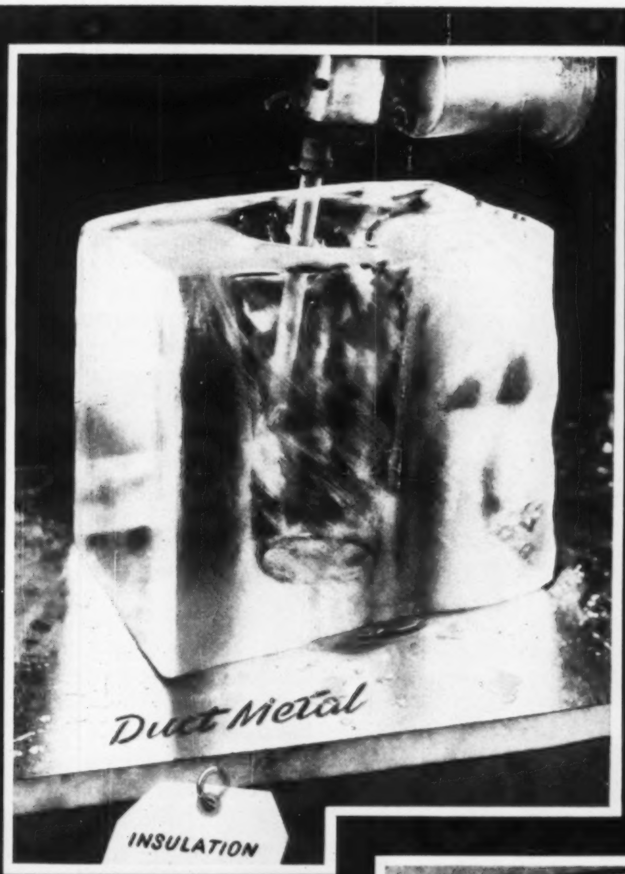
NIAGARA "Type A" is the small machine that does a big job, giving you a third to a half greater cooling capacity for its size than conditioners that do not achieve saturation of the air. Thus it has unequalled flexibility, absorbing sudden peak loads and atmospheric changes, holding its required conditions, protecting your valuable materials or your critical processes from loss or damage. Its operating range, using Niagara "No-Frost"® liquid below the freezing point of water is through 140° F. Many Niagara units have given this precision for twenty long years of service.

Write for bulletin 58 and 122.

NIAGARA BLOWER COMPANY

405 Lexington Ave., New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada



3M ADHESIVES STAND UP TO TORRID HEAT, SUB-ZERO COLD

. . . bond insulation "for keeps"!

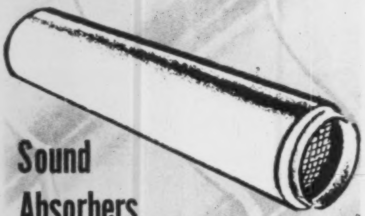
Whether operating conditions are sub-zero or torridly hot, there are 3M® Brand Insulation Adhesives that can stand the punishment. Insulation Adhesive Tacky, for example, provides strength-to-spare bonds that are *not* weakened even by –35°F temperatures or by heat up to 300°F for continuous service, up to 500°F for short periods! 3M provides a complete line of insulation adhesives for various temperature and application requirements. They bond insulation to insulation, to ducts, to wall and other surfaces—provide other advantages as well. For instance . . .

3M Insulation Adhesive Non-Flammable assures safety even when applied under fire-hazard conditions created by sparks, welding or open flames . . . and when dry, this adhesive is highly water-resistant. 3M Insulation Adhesive Fast-Drying provides unusually high coverage at low cost—can be sprayed to coat up to 350 square feet. Whatever the insulation bonding job, your nearby 3M distributor will help you select the right 3M Adhesive.

For every construction need, 3M provides today's most complete, most reliable adhesive line. Besides insulation adhesives, there are 3M products that seal high-velocity ducts, curtain walls, other joints and surfaces . . . that bond ceramic, clay, vinyl and rubber tile as well as wood, laminates, other materials. For complete information, see Sweet's Catalog, your distributor, or send for the new booklet that explains the entire 3M construction adhesive line. Write AC&S Division, 3M Company, Dept. SBHX-111, St. Paul 6, Minnesota.

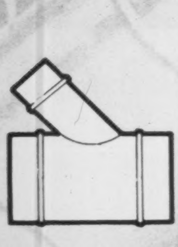
Adhesives, Coatings and Sealers Division 3M COMPANY

AMMCO



Sound Absorbers

Helix-Lockseam Pipe



Fittings

AMERICAN METAL
MANUFACTURING COMPANY
601 FIRST AVENUE
DALLAS 10, TEXAS

RECENT TRADE LITERATURE

Continued

Pressure Regulator Control

Application guides show how to hook up self-operated regulators for remote control of steam and water pressure. Discuss applications such as: remote control of manual shut-off; remote shut-off by fluid pressure; electrically operated remote shut-off; remote adjustment of remote-mounted pilot; and remote adjustment for a minimum pressure. Guides describe sequence of operation. — *Spence Engineering Co., Inc., 32 Grant St., Walden 2, N.Y.*

Fluid System Seals

Two page bulletin E15 describes "Pallseal," stainless steel and "Viton A" seal for fluid systems operating at between −65 and 500 F and up to 10,000 psi. Gives construction data and information on materials, dimensions, and standard sizes available. — *Pall Corp., Glen Cove, N.Y.*

Boiler Feedwater Treatment

Twenty-four page bulletin 30 answers such questions as: "How pure must feedwater be?" "How does operating pressure influence boiler water composition requirements?" "What is meant by 'external' and 'internal' feedwater treatment?" and many more. — *Nalco Chemical Co., 6216 W. 66th Place, Chicago 38, Ill.*

Air Handling Troffer

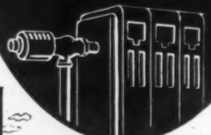
Bulletin B covers units available in 1 by 4 in., 2 by 4 in., and 2 by 2 in. sizes and capacities up to 200 cfm. Provides heating, ventilating, and air conditioning as well as lighting. — *Thomas Industries Inc., Benjamin Div., 207 E. Broadway, Louisville, Ky.*

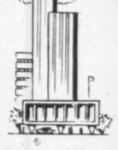
COLD
NORMAL

Sterlco®

THERMOTROL

ACCURATE, INDIVIDUAL ROOM TEMPERATURE CONTROL . . . FOR STEAM OR HOT WATER SYSTEMS





Schools, Offices and Apartments

Institutions, Hospitals and Public Buildings

EVEN HEAT

Controls each unit of radiation independently . . . provides heat only when temperature in room or small area falls below Thermotrol setting. Eliminates thermostats and zone valves.

SAVES FUEL

Thermotrol installations often pay for themselves in fuel savings. Prevents overheating and waste of fuel. Excellent for correcting unbalanced systems. Heat used only when and where it is needed.

EASILY INSTALLED

Completely self-contained . . . requires no connection to power supply, or external control device. As easy to install as ordinary radiator valves.

Leaders since 1916

Sterling inc.

5202 W. Clinton Ave., Milw. 23, Wis.

RECENT TRADE LITERATURE

Continued

Automatic Temperature Control

Four page bulletin F-10151-1 describes a complete line of equipment that provides automatic temperature control of all damper-controlled air conditioning classroom unit ventilators. Explains use of motor operator-integral thermostat combinations, plug-in control and power wiring, and unit-mounted controls. Units available with plug type power supply cords and plug-in intercomponent control wiring. — *Barber-Colman Co., Dept. 2340, Rockford, Ill.*

Coolers and Condensers

Sixteen page catalog No. 561 describes horizontal core, air cooled heat exchangers for the cooling and temperature control of oil, water, and gases, or for condensing vapors. Design features are covered with a brief description of each one as seen in a full page cutaway photo. Lists applications, construction data, and accessory equipment. Includes dimensional drawings. — *Young Radiator Co., 709 S. Marquette St., Racine, Wis.*

Humidity Instrumentation

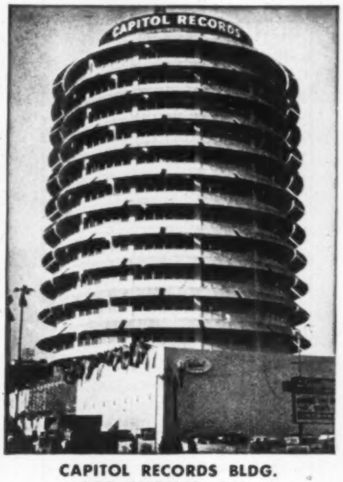
Eight page catalog SF-1 describes a complete line of basic hygrometer instrumentation and systems. Includes sensing elements, indicators, recorders, controllers, transmitters, and accessories. Illustrated with photos and tables. — *Hygrodynamics Inc., 949 Selim Rd., Silver Spring, Md.*

Motors and Drives

Four page bulletin 113 discusses the application of motors and drives as used in chemical process piping systems. Features gearmotors, adjustable speed drives, and explosion-proof, non-ventilated, drip-proof, and wound rotor motors. Illustrated with numerous application and product photos. — *Louis Allis Co., Dept. P, 427 E. Stewart, Milwaukee 1, Wis.*

Air Conditioning Units

Sixty-four page bulletin 34 describes central station units that supply heated or cooled air simultaneously and independently to several zones. Available in 34 sizes, horizontal or vertical arrangement, and three types of fan assembly. Provides data on construction, operation, weights, dimensions, coil selection, fan performance, coil ratings, K factors, and other data. Illustrated with photos, drawings, charts, and diagrams. — *Marlo Coil Co., 7100 S. Grand Ave., St. Louis 11, Mo.*



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

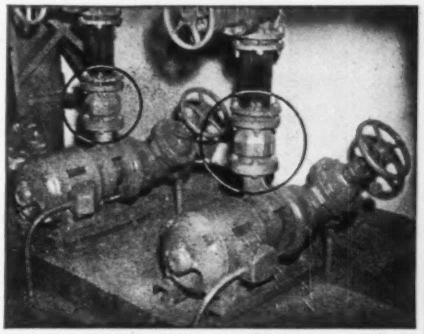
MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

SIZES 1" THROUGH 24"

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE



Write for literature • Agents in Principal Cities

MILLER VALVE CO., INC.

Pittsburgh 30, Pa. **Plant—1620 Pennsylvania Ave.**

RECENT TRADE LITERATURE

Continued

Direct Fired Gas Heaters

Eight page handbook GN-200 discusses general space heating, special heating for loading door areas and entries, make-up air tempering, and combination heating-cooling systems. Includes additional considerations such as venting procedures and heating controls. Includes an example of a heat load calculation and equipment selection procedure for a typical industrial plant. Illustrated with photos, application diagrams, and suggested equipment layouts. — *Reznor Mfg. Co.*, 51 *Union St., Mercer* 8, *Pa.*

Leak Detectors

Eight page bulletin GEA-6817A gives data on line of portable, halogen sensitive, electronic leak detectors. Units locate pressure and vacuum leaks as small as 1/100 cu in. per day. Includes operational data, specifications, and accessories. Illustrated with photos and tables. — *General Electric Co., Schenectady* 5, *N.Y.*

Air Handling Units

Bulletin No. 6011C contains information on coil selection, design problems, and air conditioning and heating fan capacities. Also gives coil ratings and complete dimensional data. — *Dunham-Bush, Inc.*, 179 *South St., West Hartford* 10, *Conn.*

Gas-Fired Unit Heaters

Four page bulletin No. A-917 describes centrifugal blower type units available in eight sizes from 50,000 to 250,000 Btu per hr input. Gives operating instructions, construction, and dimensional data. Performance data includes heat input, heat output, and information on air delivery, blower pulley, and motor for each size. — *American-Standard Industrial Div., Detroit* 32, *Mich.*

Shielding Gases

Four page form ADR 135 tells how to select the right shielding gas for welding any metal with either the consumable (MIG) or non-consumable (TIG) electrode processes. Discusses argon, helium, carbon dioxide, and combinations of argon-helium, argon-oxygen, argon-hydrogen, and nitrogen-hydrogen. Illustrated with photos and charts. — *Air Reduction Sales Co., Div. of Air Reduction Co., Inc.*, 150 *E. 42nd St., New York* 17, *N.Y.*

GET RID OF HARMFUL AIR
RAPIDLY! POSITIVELY!
AUTOMATICALLY!

...with Sarco air eliminators and air vents

...FROM DRY RETURN LINES OF TWO PIPE LOW PRESSURE OR VACUUM HEATING SYSTEMS

Sarco Float Type Air Eliminators (non-thermostatic) will do the job. Its vacuum check allows air to escape, and closes to prevent air passing back into the system. Type 6 for small capacities; Type 13S for large. Another, Type 6T, has a float plus a thermostatic bellows for use where steam, air and condensate may be present, as in one pipe heating system. Steam pressures to 15 psi.

...FROM MECHANICAL STEAM TRAPS... STORAGE HEATERS...WATER HEATERS, ETC.

Air in a steam system lowers temperature — retards heat transfer — uses more fuel — slows warm ups — binds steam traps. You can get rid of it easily and economically with Sarco Thermostatic Air Vents, Type VS. Here's how:

The temperature-sensitive element closes and opens the air vent automatically, on the balanced pressure operating principle. It opens to discharge a low temperature air/gas mixture; closes as soon as pure steam temperature is reached. There's no chance of human error. Steam pressures to 225 psi.

...FROM WATER HEATING OR COOLING SYSTEMS

You'll eliminate the air pockets which prevent or retard circulation if you install Type 13W or 13WH Sarco Air Eliminators at each high point in these applications: convector or radiant hot water heating systems; high pressure, high temperature hot water; circulatory chilled and condenser water lines in air conditioning installations; process liquid lines. Pressures to 150 and 300 psi.

For more information, contact your Sarco sales representative, district office, or distributor, or write. 5962

SARCO

SARCO COMPANY, INC.
635 MADISON AVE., NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

SEE OUR CATALOG IN SWEET'S
OR WRITE FOR COPY

Install Insulation with

TUFF-BOND

Super-Strength Adhesives

TUFF-BOND #7
... fire-retardant adhesive for installing insulation

TUFF-BOND M-102-H
... duct liner adhesive

TUFF-BOND 21-C
... clear lap sealer and lap adhesive

TUFF-BOND 21-W
... white lap sealer and lap adhesive

TUFF-BOND #6
... non-flammable fire-retardant duct liner adhesive; meets Interim Federal Standard #00136.

TUFF-BOND #9
... for bonding rigid and semi-rigid plastic foams (polystyrene, urethane, isocyanate, etc.) to themselves and to other materials.

TUFF-BOND #12
... high pressure duct sealer

TUFF-BOND QUIK SET
... neoprene-base, fast-setting adhesive. Recommended for installing metal and nylon hangers to smooth surfaces.

TUFF-BOND GENERAL PURPOSE IMPROVED
... all-around adhesive for installing insulation, insulation hangers, etc.

Ask for literature and prices.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 26, ILLINOIS

RECENT TRADE LITERATURE

Continued

Metalworking Machinery

Twelve page bulletin No. 90-6 describes a large variety of equipment used in the metalworking industry. Includes benders, forming rolls, pipe threading machines, presses, shears, welders, and many other types of equipment. Equipment is made by a number of different manufacturers. — *Joseph T. Ryerson & Son, Inc., 2558 W. 16th, Chicago, Ill.*

Heating, Cooling Coils

Bulletin No. 6001A presents engineering and selection data for direct expansion coils for cooling; water coils for cooling and heating; and steam coils, standard and non-freeze. Includes coil capacities and construction data, rating tables, and lists summer and winter climatic conditions for the U.S. and Canada. — *Dunham-Bush, Inc., 179 South St., West Hartford 10, Conn.*

Two-Way Radios

Twenty-four page brochure ECR-901 gives data on tubed and transistorized VHF two-way radios in powers of 100 w and less. — *General Electric Corp., Communication Products Dept., Section P, P.O. Box 4197, Lynchburg, Va.*

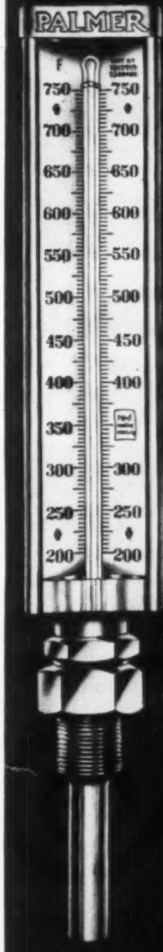
Prefluxed Copper Fittings

Six page bulletin describes cast bronze and wrought copper "Color-Guard" fittings that are chemically cleaned of oxidizing elements, protected with a micro-thin coating of tin, and prefluxed. Can be stored indefinitely under normal conditions without additional cleaning or fluxing. Illustrated with photos. — *Nibco Inc., Elkhart, Ind.*

TODAY'S MODERN INDUSTRY
DEMANDS A MODERN THERMOMETER

PALMER

RED-READING MERCURY THERMOMETERS



Red-Reading Mercury
•
Extruded Brass Case
•
Chrome Finish
•
Ranges:
—40 to 950°F
or Equivalent in °C

WRITE FOR
COMPLETE INFORMATION

Ask for
Bulletin No. 35

Find Your
Palmer Representative
In The
Yellow Pages

PALMER

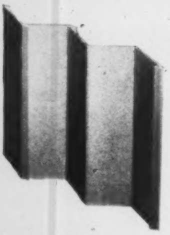
PALMER THERMOMETERS, INC.

Mfrs. of Industrial Laboratory, Recording
and Dial Thermometers • Cincinnati 12, Ohio

SOPLASCO
PLASTIC
Moisture
ELIMINATOR
BLADES
FOR INDUSTRIAL
AIR CONDITIONING
ARE

VERSATILE

SOPLASCO Plastic Moisture Eliminator Blades not only solve moisture control problems in industrial air conditioning, but are well adapted to other industries. Excellent use can be made of these blades for moisture removal of plating condensate in electroplating and in chemical application and processing for moisture elimination.



Southern
Plastics Co.
408 Pendleton St.
Columbia, S. C.

For further information write, wire, or phone SOPLASCO AIR PRODUCTS DEPT.

RECENT TRADE LITERATURE

Continued

Recorders

Twelve page bulletin GEA-6933A gives data on full line of direct, servo-operated, switchboard, and portable recorders. Describes 19 different types of single, multi-pen, ink, inkless, strip, and round chart units. For selection purposes, recorders are described in accuracy classes of ¼, 3/10, 1, 2, and 3 percent. Includes operating data, accessories, specifications, dimensions, and applications. Illustrated with photos and tables. — *General Electric Corp., Schenectady 5, N.Y.*

Brazing Alloys

Reference chart lists metal compositions, density, and melt and flow temperatures for 37 "Silvaloy" silver brazing alloys and 19 "Engaloy" precious metal brazing alloys. — *Engelhard Industries, Inc.,* 75 *Austin St., Newark* 2, *N.J.*

Hot Water Heating Equipment

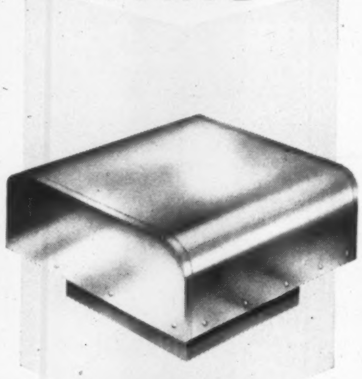
Sixteen page form 1551B describes the ASME expansion tank, steam, and water converters, circulators, valves, and fittings. Contains a typical converter installation diagram, other installation diagrams, specifications, performance curves, and pressure drop tables. — *Dunham-Bush, Inc.,* 179 *South St., West Hartford* 10, *Conn.*

Ball Valves

Two page bulletin covers ball valves for steam, water, oil, liquid chemicals, and gas handling. Units made from bar stock (stainless steel or cadmium-plated carbon steel) with a top entry design. Illustrated with an exploded view, photos, charts, and engineering drawings. — *Strong,* 508 *Sandusky St., Conneaut, Ohio.*

LOW
PROFILE

DAVIDSON
ROOF EXHAUST
FANS



PC Pleasing Contour Model

Designed to "hug the roof", the low-contour PC Model is as much as 40% lower than conventional units.

Capacities up to 50,000 CFM with low velocity.

- Quiet, vibration-isolated operation
- Famous Davidson rugged construction
- NEMA Standard Motors
- Ratings conform to Standard Test Code
- Unconditional performance guarantee

For complete facts about PC Fans and Hyduty SS Fans, write:

DAVIDSON FAN CO.

Dept. F, 213 California St.
Newton 58, Mass.

The original manufacturer of roof fans — Founded 1915

Member AMCA

RECENT TRADE LITERATURE

Continued

Constant Pressure Pumping

Bulletin EF-250A describes system that consists of pump, motor, drive coupling, and control. Variable speed coupling accelerates or decelerates the pump speed as required. Motor operates at a constant speed and the pressure control is connected to the building riser. The variation in demand governs the output speed of the drive and the capacity developed by the pump, thus maintaining a constant pressure. — *Weil Pump Co., 1530 N. Fremont St., Chicago 22, Ill.*

Engineering Reference Guide

A 3½ by 6½ in. plastic-enclosed card contains key data used by designers of air conditioning systems. Includes a psychrometric chart, refrigerant weights, volume, enthalpy and pipe sizes, and approximate heating and cooling operating costs and capacity requirements for such typical applications as office buildings, apartments, schools, and others. Also contains conversion and air cooling formulae, sheet metal weights per linear ft, and formulae for determining fixed charges. — *Carrier Air Conditioning Co., Carrier Parkway, Syracuse 1, N.Y.*

End Mounted Industrial Pumps

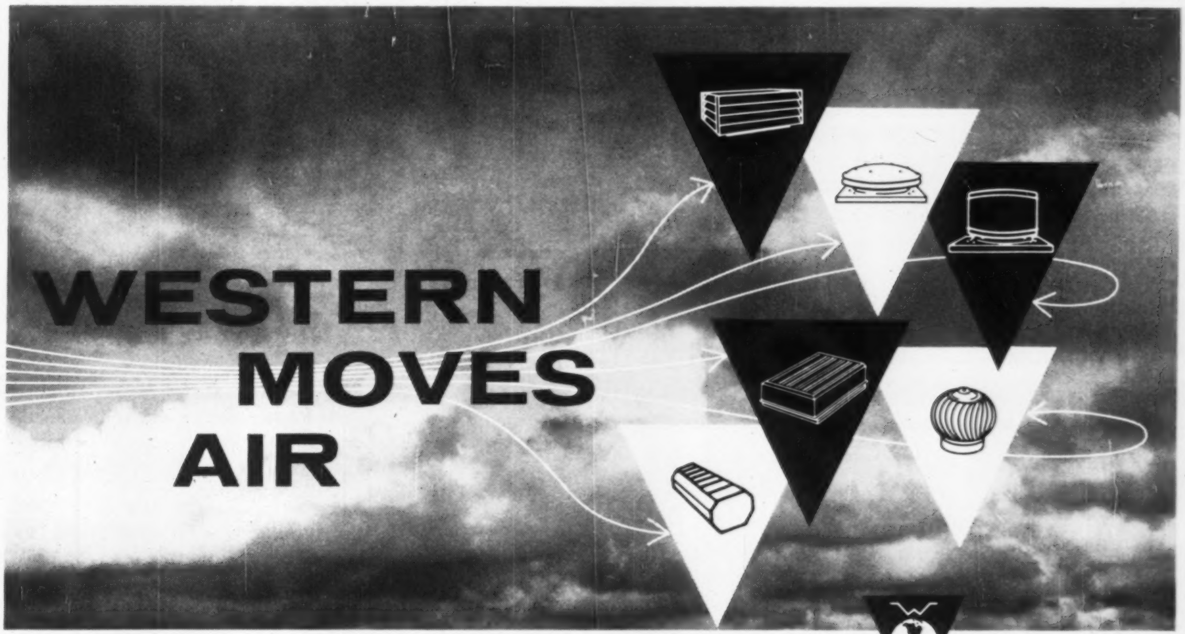
Two eight page repair manuals are available for both end mounted sealed and end mounted packed industrial pumps. Manuals specify tools to be used; complete disassembly and reassembly instructions; cleaning and inspection hints; and general information. Illustrated with photos, exploded views, and line drawings. Bulletin M101-4 describes packed pumps; bulletin M101-5 describes sealed pumps. — *Roy E. Roth Co., Turbine Pump Div., Rock Island, Ill.*

Air Pumps

Sixteen page descriptive price list No. 61261 gives latest prices on complete line of rotary vacuum pumps, pressure pumps, gas boosters, and accessories. — *Leiman Bros., Inc.,* 102 *Christie St., Newark* 5, *N.J.*

Masonry Saws

Article tells how to care for masonry saws. Includes such subjects as proper voltage, equipment operation and maintenance, blade selection, and good sawing techniques. — *Clipper Mfg. Co.,* 2800 *Warwick, Kansas*



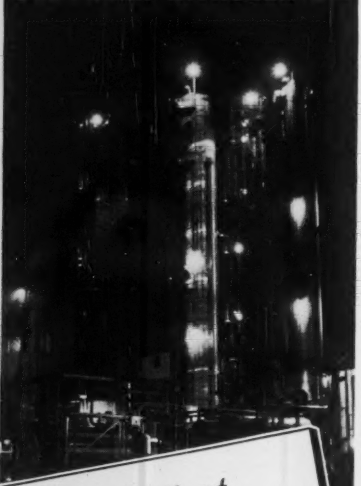
Exhausting/Supplying air has been Western's only business for 40 years. Ask about system engineered quality roof ventilators next time you have an air moving problem. Western's complete line of compact centrifugal, axial, and gravity equipment is engineered to move air efficiently and economically. Complete engineering service and maximum production flexibility enable Western to solve your special ventilation problem. Write for catalog and name of nearest representative.

WESTERN ENGINEERING & MFG. CO.

P.O. Box 66455, Los Angeles 66, California

MEMBER OF AIR MOVING AND CONDITIONING ASSOCIATION, INC.

For the Savannah Plant
of
SOUTHERN NITROGEN CO.



"...excellent trouble-free service" against SURGE PRESSURES

Handling hot potassium carbonate requires safeguarding pumps and piping systems against dangerous pressure surges. Eight Williams-Hager Silent Check Valves—similar to the one shown at right—guard Southern Nitrogen's Savannah Plant by operating *instantly* when flow reversal starts or when flow is zero.

Write for Bulletins: #654 on Valves; #851 on Cause, Effect and Control of Water Hammer; #659 on Pressure Loss Tests.

WILLIAMS • HAGER
Silent
Check Valves

The Williams Gauge Company, Inc.
155 Stanwix Street • 2 Gateway Center
Pittsburgh 22, Pa.
Our 75th Year • 1886-1961

RECENT TRADE LITERATURE

Continued

Filters and Strainers

Four page bulletin D7 gives details on complete line of refrigeration pipe line filters and strainers, plus comparative data on filters and strainers, and the importance of low side filtration. Includes four models of filters for ½ to 20 ton systems, recommended for permanent suction and liquid line installation. Also shows cleanable strainers in flanged, demountable shells and sealed strainers. — *The McIntire Co., Livingston, N.J.*

Flow Measurement, Control

Eight page bulletin 116 explains measurement and control of flow rates in pipe sizes as high as 48 in. Gives data on capacity determination, flow range data, piping requirements, and the use of "rotameters" in by-pass arrangement. — *Brooks Instrument Co., Inc., Hatfield, Pa.*

V-Band Coupling

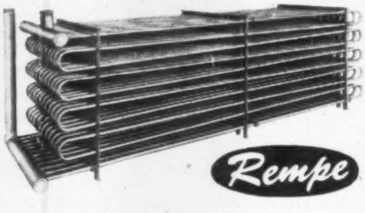
Sixteen page booklet, *Economics of the V-Band Coupling*, No. SDP-2 gives specific cost comparisons between V-bands and other joining methods. Also discusses design adaptability. —*Aeroquip Corp., Marman Div., 11214 Exposition Blvd., Los Angeles, Calif.*

Gate Valves

Four page circular 561 describes valves made in two types: iron body, bronze mounted for general corrosive service; and all iron for solutions that attack bronze. Lists pressures and w-o-g pressure ratings, as well as specific dimensions for various designs. Illustrated with photos, tables, and line drawings. — *Lunkenheimer Co., P.O. Box 360, Annex Station, Cincinnati 14, Ohio.*

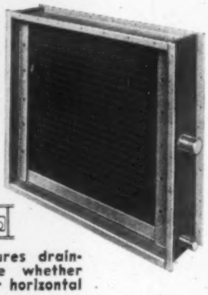
REMPE
Heat Transfer Equipment

PIPE COILS
Custom Engineered to
Your Requirements



HEAT RECLAIMING UNIT
Typical of the many varieties of coils produced by Rempe from any type of ferrous or non-ferrous pipe and tubing.
Coil illustrated is 15' long with 5" copper headers. Used in floor pit for reclaiming heat from waste process water to preheat boiler feed water. Ideal for reclaiming heat from any hot waste liquid and reducing fuel cost.
Tell us your problem
We'll design the coil

HEAVY DUTY
STEAM
COILS
Distributor
Type



Tilted feature assures drainage of condensate whether used for vertical or horizontal air flow.

Non-Freeze Design

Every square foot of face area produces equal heating capacity on full or modulated steam supply. Suitable for pressures to 200 lb. gauge.

Two row or one row available. Can be furnished with connections as shown or on opposite end of coil.

Write for Details

Rempe

Engineering Data Book
Pipe Coil and Fin Coil Designs. Heat Transfer Coefficients. Get a copy for your library.

REMPE COMPANY
342 N. Sacramento Blvd. • Chicago 12, Ill

Cut Idle Time This Winter

• • •

DON'T HOLD UP LAGGING JOBS FOR HIGHER TEMPERATURES

• • •

Use CLAIR COAT

Lagging Adhesive for FAST LAGGING even in a damp 40° F.

And if CLAIR COAT should freeze solid — it still is usable.

Other CLAIR COAT Advantages:

FAST SETTING — sets almost immediately

NONFLAMMABLE — fire retardant film

STRONGEST PERMANENT BOND—by comparative tests

STEAM PROOF — WATER PROOF — VERMIN PROOF NON - TOXIC

ONE COAT NEEDED — fine appearance — long lasting — easily washable

***Also*-NEW** ST CLAIR LAP SEALING ADHESIVE #**45007**

MANY IMPORTANT ADVANTAGES— write for prices — samples of either or both adhesives

ST. CLAIR RUBBER CO.

Empire Bldg.
107 Clifford St. Detroit 26, Mich.

RECENT TRADE LITERATURE

Continued

Heat Exchangers

Thirty page catalog No. AX60 explains units for controlled steam heating of water. Includes a combination index and rating chart. Gives capacities in gpm and pressure drop in ft of water for convertors, radiant heating and snow melting heaters, and other units. — *The Alstrom Corp., 790 E. 176th St., New York 60, N. Y.*

Oilers, Controls, Lubricators

Four page circular No. 580 describes bottle oilers for plain bearing lubrication, constant oil level controls, glass body oil cups, and bronze oil cups. Includes dimensions, oil capacities, installation techniques, and application methods covering a wide range of bearing lubrications. — *Lukenheimer Co., P.O. Box 360, Annex Station, Cincinnati 14, Ohio.*

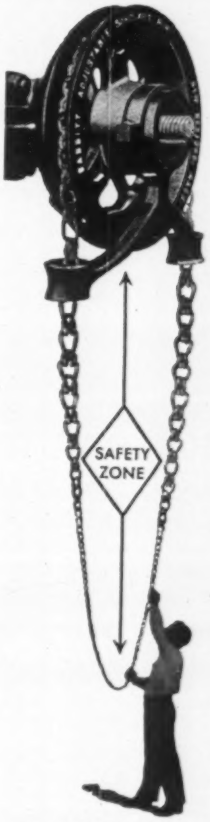
Direct Current Source

One page product sheet 102 describes small constant voltage supply employed in potentiometer and bridge type instruments. Output accuracy is 1.5 v, d-c, ±0.0037 at rated load of 1.4 milliamps at 68 F. Operating temperature range is 32 to 140 F. — *Thermo Electric Co., Inc., Saddle Brook, N.J.*

Fuel Oil Heaters

Eight page bulletin 200 describes heaters used on the suction side of the pump to heat viscous fluids to reduce their viscosity. Includes data on materials and code, pressure-temperature ratings, heater lengths and sizes, shell nozzle orientation and sizes, tables of dimensions, and drawings. — *Brown Fintube Co., 300 Huron St., Elyria, Ohio.*

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide
Changes that Danger Zone to a SAFETY ZONE



—enables you to

ADD PLANT AREA

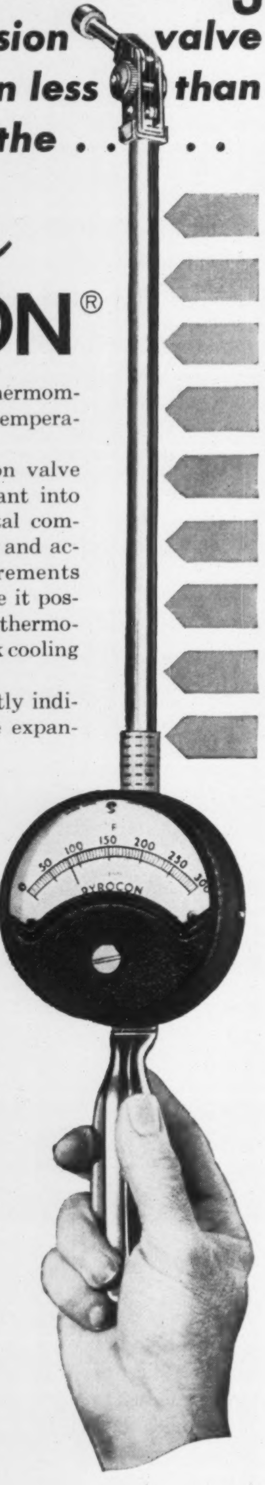
If re-aligning equipment will yield more working space, better production, lower costs—do it now. Save all space wasted for placing ladders to reach overhead valves. At the same time, convert Danger Zones to Safety Zones. Equip every overhead valve wheel in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. Just phone your mill supply salesman or contact us direct.

188-9

Babbitt
STEAM SPECIALTY CO.
8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.



For Air Conditioning

Thermal expansion valve set accurately in less than a minute with the . . . . .

Alnor PYROCON®

Eliminate the clumsy, slow thermometer method of determining temperatures in the system.

The thermostatic expansion valve controls the flow of refrigerant into the cooling coil and is a vital component of any system. Quick and accurate temperature measurements with the Alnor Pyrocon make it possible to properly adjust the thermostatic expansion valve for peak cooling coil efficiency.

The Alnor Pyrocon instantly indicates the temperature at the expansion valve bulb location. From this temperature, subtract the temperature corresponding to the evaporator pressure. The temperature difference represents the precise superheat and enables the operator to make a perfect setting of the expansion valve immediately.

Pyrocon model 4000 with a temperature range of 0-300° F. is recommended. Price with case including shielded thermocouple tip $125.00 f.o.b. Chicago.

The Pyrocon is also ideal for testing steam traps, balancing hot water systems, locating hot water pipes in cement floors, testing panel heating in walls, floors or ceilings, or making any surface temperature reading.

Other models with ranges up to 0-2000° F. and subzero ranges also available.

Write for Bulletin 4257

Alnor INSTRUMENTS

ALNOR INSTRUMENT CO.
Division of
Illinois Testing Laboratories, Inc.
Room 513, 420 N. La Salle St., Chicago 10, Ill.

RECENT TRADE LITERATURE

Continued

Electro-Galvanized Steel Sheet

Four page bulletin gives data on steel sheet made from zinc concentrates. "Lifekote" is supplied with either plain zinc; phosphate coated surfaces; or a final chemical treatment. Withstands high deformation without flaking. Can be spot welded and fabricated. — *The Canfield Steel Co., Canfield, Ohio.*

Temperature Control Valves

Twenty page catalog covers "Zone-A-Trol" valves, damper actuators, and accessories. Also describes thermostats, power accessories, and other controls. Gives data on application, installation, and wiring. — *Econo Products Co., Div. of Viking Instruments, Inc., East Haddam, Conn.*

Pressure-Sensitive Tapes

Eight page booklet DB-56A discusses selection and construction of tapes. Also shows trouble-shooting procedures concerned with tape failures; gives a glossary of terminology applied to tapes. — *Johns-Manville, Dutch Brand Div.*, 22 *E. 40th St., New York* 16, *N.Y.*

Heating Equipment

Twenty page catalog H-61 consists of three sections covering oil burner nozzles, accessories, and draft controls. Nozzle section includes gph capacity and spray angle charts and illustrated spray patterns. Illustrated further with photos, tables, and line drawings. — *Wm. Steinen Mfg. Co., Heating Div.*, 47 *Bruen St., Newark* 5, *N.J.*

Bronze Bearings

Catalog explains all styles of "Lube-Align" bearings. Bearing unit features a one-piece, self-aligning, integrally cast spherical self-lubricating bronze bearing nested in an aluminum housing. Available in a choice of mountings in a wide range of stock sizes. Special sizes also available. — *Bronze Bearings, Inc.*, 3553 *Addison St., Chicago* 18, *Ill.*

RECENT TRADE LITERATURE

Continued

Vertical Centrifugal Pumps

Eight page bulletin 8008 describes vertical centrifugal wet pit pumps (screenless). Sizes range from 75 to 1200 gpm at heads of 10 to 75 ft. Includes dimensions and typical specifications. Illustrated with photos, line drawings, and tables. — *Yeomans Brothers Co.*, 1999 *N. Ruby St., Melrose Park, Ill.*

Gate Valve

Eight page bulletin 302 covers rubber seated bonnetless knife gate valve. Lists materials, dimensions, and actuators. Outlines the broad areas where the valve is extensively used. -- *DeZurik Corp., Sartell, Minn.*

Evaporative Coolers

Four page catalog 1961-4P gives information on evaporative coolers for cooling jacket water, lube oil, compressed air and natural gas, or for condensing steam and hydrocarbons. Various sections cover piping diagrams of sample units and dimensional drawings and tables. — *Young Radiator Co.*, 709 *S. Marquette St., Racine, Wis.*

Gas-Fired Infra-Red Heaters

Sixteen page application manual PE-2-61 discusses applications involving full heating requirements or spot heating. Covers such topics as body heat loss and average outdoor winter temperatures for all parts of the country. Illustrated with seven tables and 11 graphs and engineering drawings. Indexed for quick reference. — *Pearsall & Schael,* 46 *Osborne Ave., East Norwalk, Conn.*

Tandem Combustion Units

Two page bulletin 50, supplement 4, describes unit with an oil burner combined with a non-aerated gas burner. Available in nominal sizes from 1 to $2\frac{1}{2}$. Capacities range from $1\frac{1}{2}$ to 12 million Btu per hr with furnace draft of 0.2 in. WG. Illustrated with photos, line drawings, and tables. — *National Airoil Burner Co., Inc.*, 1284 *E. Sedgley Ave., Philadelphia* 34, *Pa.*

Aladdin
AIR HANDLING EQUIPMENT

Type "S" *Centrifugal*
ROOF VENTILATORS

- **CERTIFIED RATINGS**
- **ALUMINUM HOUSED**
- **ATTRACTIVE DESIGN**
- **WEATHERPROOF**
- **QUIET OPERATION**

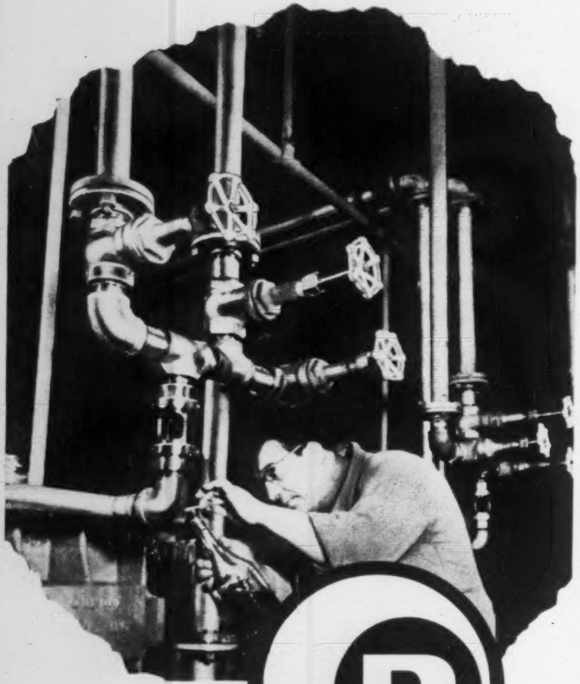
CERTIFIED RATINGS
AUTHORIZED BY
AMCA

ALADDIN Type "S" Roof Ventilators feature an attractive Spun Aluminum Housing of low contour. Designed especially for those installations which require a small powered exhaust unit. The Type "S" Roof Ventilator is ideally suited for schools, hospitals and similar type buildings.

Seldom requiring maintenance, these units are furnished with unusually quiet, fan cooled motors with outstanding lubricating systems, assuring long, continuous service under severe conditions of dust and dirt.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA



CA R

STAINLESS

pipe & fittings
in stock...

Stainless steel piping for process installations, like the one pictured in Mogen David Wine Company's modern Chicago plant, can be readily supplied from our warehouse stock.

We maintain a large inventory of light-wall, standard, and extra-heavy stainless pipe in a variety of sizes and analyses — plus threaded and welding fittings, and valves.

Rely on C. A. Roberts Co. for prompt service and expert technical assistance on your Stainless Piping requirements.

C. A. ROBERTS CO.
Steel & Aluminum Tube Specialists
Dept. E-11 • 2401 25th Avenue • Franklin Park, Ill. • GLadstone 5-6400
6 ***Warehouses serving the middlewest***
CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • TULSA • KANSAS CITY

RECENT TRADE LITERATURE

Continued

Automatic Data Loggers

Six page bulletin D 401 covers digital loggers for automatically collecting and presenting measured data in suitable form for operating, test, process analysis, and other purposes. Partial list of typical measurement inputs include pressure, temperature, liquid level, flow, position, and speed. Photos show various applications. — *The Bristol Co., Bristol Rd., Waterbury, Conn.*

Air Conditioning Ceilings

Thirty page catalog 62 includes treatment of integrated air conditioning ventilating acoustical ceilings in a list of over 440 types and qualities of acoustical products. — *Elof Hansson, Inc., Acoustical Div., 711 Third Ave., New York 17, N.Y.*

Die-Cut Parts

Folder describes the materials and services firm can provide in custom die-cutting gaskets, insulating parts, and structural pieces in the air conditioning, heating, and allied fields. — *Beaverite Products, Inc., Die-Cutting Div., Beaver Falls, N.Y.*

Brazing Stainless Steel

Four page bulletin, *Brazing News No.* 85, *Stainless Steel Edition*, shows various examples of brazed stainless steel. Tells what brazing can do and what purposes stainless steel is used. Illustrated with photos. — *Handy & Harman, 850 Third Ave., New York 22, N.Y.*

Prefabricated Round Air Duct

Two bulletins describe duct made of fine glass fibers, bonded together and molded into a tube. Available in 6-ft sections in the same inside diameters as standard round sheet metal duct, and will slip on standard galvanized fittings. Combines air duct, thermal insulation, vapor barrier, and sound absorber in one material. Illustrated with photos, and tables. — *Armstrong Cork Co., Lancaster, Pa.*

RECENT TRADE LITERATURE

Continued

Packaged Boilers

Bulletin No. 1275 describes boiler with a side located furnace which permits boiler feed injection and natural thermal circulation to augment each other. Capacities available from 50 to 100 hp. Includes ratings, dimensions, and approximate fuel consumption. — *Orr & Sembower, Inc., Reading, Pa.*

Pipe Insulation

Two page bulletin describes "Hewflex" urethane pipe insulation. Cellular structure offers thermal protection and makes insulation impervious to moisture vapor. Illustrated with line drawings. — *United Foam Products Co., 2990 Industrial Blvd., Bethel Park, Pa.*

Steam Heating Specialties

Eight page form 1501D discusses radiator valves, inverted bucket traps, radiator traps, high pressure thermostatic traps, float and thermostatic traps, strainers, and gages. Includes 56 illustrations and product drawings. Gives capacities, dimensions, and weights. — *Dunham-Bush, Inc., 179 South St., West Hartford, Conn.*

Gas-Fired Unit Heaters

Two catalog sheets, 2760-3 and 2760-4, discuss unit heaters delivering up to 240,000 Btu per hr. Uses natural, mixed, manufactured, and LP gases. Air flows from 600 to 3600 cfm at 70 F available. Illustrated with line drawings, photos, and tables. — *Young Radiator Co., 709 S. Marquette St., Racine, Wis.*

Electric Motors

Three section instruction manual covers oil-lubricated motors in frame sizes 254 UP through 445 UP. Sections include installation, operation, and maintenance-repair. A two page chart gives symptoms, along with probable cause and remedy, for such things as motor failing to start, failing to come to speed, running hot, vibrating, or running noisily. — *U. S. Electrical Motors Inc., P.O. Box 2058 Terminal Annex, Los Angeles 54, Calif.*

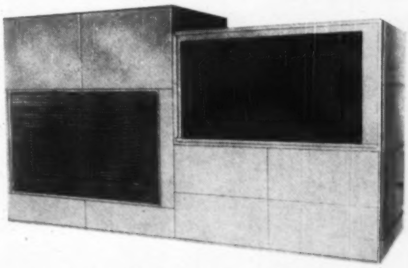
A Pre-Engineered
Custom Built

usAIRco

SELF CONTAINED
CENTRAL STATION
AIR CONDITIONER

10 to 60 TON CAPACITY

Supplied as a unit with choice of integral air-cooled condenser . . . evaporative condenser . . . or water-cooled condenser.



Model illustrated: TRK60AC, 59 ton capacity

Saves Installation Cost! Saves Maintenance Cost! Opens tremendous new opportunities in shopping center, factory, bowling lane, variety chain, restaurant, amusement places and many other commercial and industrial applications.

Write for Bulletin "94A-1"
and Bulletin "93-94-22"

United States Air Conditioning Corporation
Dept. 74 Delaware, Ohio
SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES
CONSULT YOUR TELEPHONE DIRECTORY YELLOW PAGES
Export Office, 13 E. 40th Street, New York 16, N.Y., USA

Perkins AIRadiators offer 3 big advantages for Plant-Area Heating

1. Safe heat—because it's AIRadiated wet heat
2. Out-of-traffic mounting on ceilings or walls
3. Simplified installation—tapping positions are reversible

NEW CATALOG
•
Full Information on complete line of SHAW PanelVectors and PERKINS AIRadiators
•
Write For Your Copy Today

Perkins AIRadiators operate on steam or hot water to 150 psi — there are no motors, fans, or other moving parts that can cause dangerous sparking — nothing to wear or fail. They mount easily anywhere on ceilings or walls, away from equipment and traffic. Reversible tapping locations assure simplified installation in either new or existing piping layouts.

Perkins AIRadiators are made in sizes to meet every heating requirement, distribute an exact ratio of radiant and convected heat. Of rigid integral steel and copper construction, they last a plant's lifetime.

Write now for free literature. Ask for Bulletin V.

SHAW-PERKINS MFG. CO.
Properly Designed Room Heat Distribution Equipment
201 E. CARSON ST., PITTSBURGH 19, PENNA.

RECENT TRADE LITERATURE

Continued

Remote Valve Control Systems

Twenty page bulletin 618 is a design manual on equipment for the manual remote control of valves. Manual is divided into three sections: 1. covers flexible shafting for use where there are a number of bends to make and includes valve couplings, remote operating terminals, and handwheels; 2. covers standard rigid reach rod controls; and 3. covers gear boxes including a 90 deg gear box and a 300 deg swivel geared joint. Illustrated with photos, tables, and line drawings. — *Stow Mfg. Co., 350 Shear St., Binghamton, N.Y.*

Adherent Sludge Dispersives

Four page bulletin HSP-941 discusses custom engineered dispersives formulated to minimize sludge formation in boilers and recirculating cooling systems. Covers selection of dispersives based on results of physical and chemical examinations of deposits and samples needed to conduct the examinations. Several case histories dealing with sludge accumulation problems in various boilers and cooling systems are given. Illustrated with photos. — *Hagan Chemicals & Controls, Inc., Water Chemical Sales Div., Hagan Center, Pittsburgh* 30, *Pa.*

Meter-Relays

Twenty-four page bulletin No. 5 gives information on locking contact meter-relays, including operating features and standard circuits for control action. Also covers isolation coils, double locking coils, response time and damping, overload protection, and control components used with meter-relays. Gives dimensions, sensitivities, case styles, and prices. — *Assembly Products, Inc., 75 Wilson Mills Rd., Chesterland, Ohio.*

Air Control Pressure Regulators

Guide sheets (A5B10) give application data. Include hook-up diagrams, recommended installation, and steam capacity tables. How to obtain the most efficient steam use for an absorption refrigeration machine with an air control pressure regulator is described. Another guide shows how to provide remote control of a regulator, without consuming air, rerouting main piping, or adding special air piping. Guides demonstrate ways to obtain steam pressure control with standard regulators already in service. — *Spence Engineering Co., Inc., 32 Grant St., Walden 2, N.Y.*

RECENT TRADE LITERATURE

Continued

Centrifugal Pumps

Four page bulletin No. 10-C describes two types of vertical close-coupled centrifugal pumps. Type "VC" has stuffing box, packing, and packing gland; type "VCS" has mechanical shaft seal consisting of stainless steel spring, bronze rotating element with carbon ring and ceramic floating seat. Both are heavy duty cast iron-bronze fitted construction. Capacities, dimensions, and other engineering data are given in tabular form. Illustrated with photos and line drawings. — *Skidmore Corp., St. Joseph, Mich.*

Air Control Equipment

Eighteen page catalog 1161 describes air valves, blenders, and high capacity acoustic terminal control units. Air valves can have either manual or pneumatic controls, and are used for velocity and pressure reduction and balancing in single-duct systems; also used for control of static pressure unbalance in dual-duct systems. Blenders are used for control of velocity, pressure, temperature, and mixing in dual-duct systems. ATC units provide control of velocity, pressure, temperature, volume, mixing, and noise in dual-duct systems. — *Carnes Corp., Verona, Wis.*

Power Packs

Eight page bulletin GEA-7328 discusses high-voltage power packs for electrostatic equipment. Rated at 2000 through 15,000 volts, d-c output, with output current 1 amp and below. Suitable for air filtering equipment and other applications. Gives diagrams of dimensions and electrical characteristics. Includes a specification guide. Illustrated with a cutaway photo showing construction features. — *General Electric Co., Schenectady 5, N.Y.*

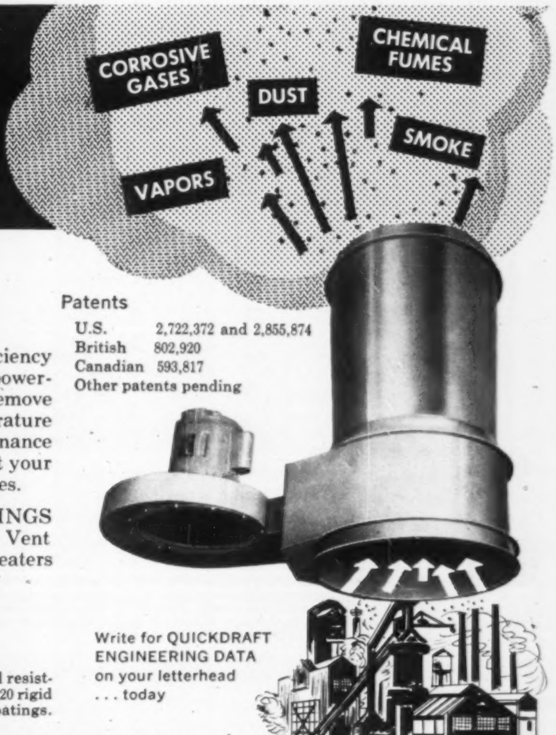
Pneumatic Receiver

Eight page product data sheet A113.3.3-2 describes plug-in 4 in. strip-chart receivers: recorders and manual-loading stations. Instruments are divided into three packages depending on function: 1. measuring and transmitting; 2. operating supervision; indication and recording, set-point adjustment, and manual-automatic transfer; and 3. automatic control. Illustrated with photos, tables, and line drawings. — *The Bristol Co., Bristol Rd., Waterbury 20, Conn.*

HIGHER COMBUSTION EFFICIENCY!
LOWER MAINTENANCE COSTS!

NO MOTORS, FANS OR BEARINGS IN EXHAUST LINE

PERFECT DRAFT-CONTROL BY **Quickdraft**

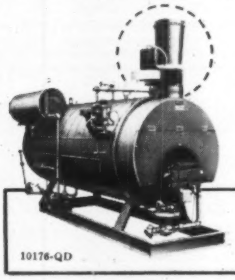


- ★ EXTREMELY HIGH NEGATIVE PRESSURES
- ★ ACID RESISTING FINISHES
- ★ HIGHLY EFFICIENT WITHOUT CHIMNEY

Patents
U.S. 2,722,372 and 2,855,874
British 802,920
Canadian 593,817
Other patents pending

FOR INDUSTRY . . . Now you can boost the combustion efficiency of your boilers, regardless of the fuel you use. Quickdraft power-draft units provide instant controlled draft and completely remove all combustion, corrosive and noxious fumes at high temperature without passing them through the blower and motor. Maintenance costs are drastically reduced. Specify a Quickdraft unit to meet your particular requirements from a wide selection of various sizes.

FOR INSTITUTIONAL AND COMMERCIAL BUILDINGS . . . Quickdraft eliminates costly, tall and unsightly stacks. Vent incinerators, heating plants and water heaters at roof level . . . safely and efficiently.



One of many actual installations with or without chimney.

FOR CORROSIVE SERVICE

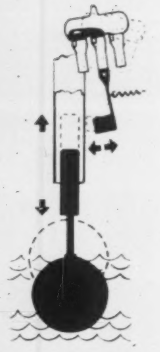
All Quickdraft units are available in standard acid resisting vitreous enamel, 316 stainless steel, carpenter 20 rigid plastics (P.V.C), and with plastic or Fiberglas coatings.

Write for QUICKDRAFT ENGINEERING DATA on your letterhead . . . today

Quickdraft
CORPORATION
P. O. Box 1353-K, Sta. C, Canton SW, Ohio

MANUFACTURERS OF ALL TYPES OF MATERIAL HANDLING UNITS WITH EXTREMELY HIGH VELOCITIES.

reliable liquid level or flow control



A **sleeve**, raised and lowered within a nonmagnetic tube by any suitable sensing means, as liquid level or flow rates change, attracts or releases a permanent magnet attached to a **mercury switch** outside the tube. That's all there is to it!

at practically any temperature or pressure

MAGNETROL

The positive pull of a permanent magnet replaces all bellows, packing glands, diaphragms and electrodes — eliminates all wearing parts.

Magnetrols operate indefinitely to control the level or flow of virtually *any* liquid — at practically *any* temperature or pressure. They are so simple that only a simple change in component material is normally needed to adapt standard units to even the most unusual operating requirements. Of course, "special" Magnetrols can be developed to meet any specific plant need.

Magnetrols are available for controlling *liquid level* changes from ¼" to as much as 150′ and more — with single or multi-stage switching; *flow switches* to signal start, stop or insufficient flow within fractions of gpm rates.

Fill in coupon and attach to your letterhead for full information.

18

MAGNETROL, Inc. 5322 Belmont Road, Downers Grove, Ill.

Please send me catalog data and full information on Magnetrol

☐ Liquid-Level Controls ☐ Flow Controls

Name____________________

WE HEAR THAT . . .

KOTON AND DONOVAN is a new consulting engineering firm that will specialize in the heating, air conditioning, and allied fields. Offices are located at the Crossroads Plaza, West Hartford, Conn.

The technical service laboratory of *ALLIED CHEMICAL CORP.* has been moved to new quarters at the company's Morris Township, N.J. research center. The new address is P.O. Box 405, Morristown, N.J.

ROBBINS & MYERS, INC. has formed a new division named the *AIRTROL DIV.* To be headquartered in Springfield, Ohio, Airtrol will specialize in the design, production, and marketing of unit type collectors for the control of dusts and mists encountered in industrial and commercial operations.

The *AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.* has made the following four appointments: Andrew T. Boggs III, associate secretary; Martin A. Mayers, manager of research; Herbert P. Tinning, technical secretary; and Robert J. Anthony, senior associate editor, ASHRAE Journal.

A new plastics division has been established by *IMPERIAL-EASTMAN CORP.* in the company's Manitowoc, Wis. plant. The division will manufacture a broad range of plastic hose and tubing for pressure applications up to 3000 psi.

VAPOR CORP. is the new official name of the former Vapor Heating Corp. Stockholders of the firm recently approved the change.

The *AMERICAN SOCIETY FOR TESTING AND MATERIALS* is the new name of the former American Society for Testing Materials. The change was made official with the signing of a court decree on September 18, 1961, amending the Society's Charter originally granted in 1902 by the Commonwealth of Pennsylvania. In announcing the change, ASTM president Miles N. Clair said, "The inclusion of the word 'and' in the Society's name places added emphasis on the Society's research work in seeking knowledge of the nature of materials."

WE HEAR THAT

Continued

METAL & THERMIT CORP. and *THE UDYLITE CORP.* have agreed in principle to a merger of the two companies. This action, which was voted on by the companies' directors, is subject to approval of a formal merger agreement by the directors for submission to the stockholders of M & T and Udylite.

AMANA REFRIGERATION OF CHICAGO, INC. has moved into new quarters at 3312 W. Bloomington Ave., Melrose Park, Ill. Amana's new home is a one story building with an area of 16,000 sq ft.

HONAN ASSOCIATES, INC. has been formed to manufacture and distribute self-cleaning air filters for use in commercial and industrial air moving and conditioning systems. Executives of the firm are P. R. Honan, president; Buren C. Crane, vice president; and C. Bratton, secretary-treasurer.

F. W. Muller, vice president of the Gustin-Bacon Mfg. Co., has been elected president of the *NATIONAL INSULATION MANUFACTURERS ASSOCIATION*. M. W. Burleson, vice president of the Johns-Manville Sales Corp. was re-elected vice president of NIMA; and Thomas J. Walters, manager of the industrial insulation division of the Ruberoid Co. is the new treasurer. John M. Barnhart is the executive secretary.

PIONEER MFG. CO. is adding a 100,000 sq ft addition to its existing plant in the City of Industry, Calif. Completion of the addition is scheduled for early 1962. Cost, along with other expansion, is expected to approach $1,000,000.

RANCO INC. and *THE EMERSON ELECTRIC MFG. CO.* have joined in a new venture in Europe to manufacture and distribute fractional hp motors. Plants will be located in Scotland and Italy. Emerson will hold a one-third interest based on investment and provision of designs and technical know-how relating to the manufacture of motors. Ranco will supply manufacturing facilities, management, and sales services abroad.

In America's Finest Buildings...

DIAMOND GRILLES

LOOK BETTER... LAST LONGER!

DIAMOND FABRICATED GRILLES

. . . meet the current demand for a very strong bar-type grille which provides more than the usual percentage of open area and is suitable, in general appearance, for use with practically any modern style of interior design. Specified by leading engineers and architects for Schools, Colleges, Hospitals, Ocean Liners, Sports Arenas, etc. Custom Built (no standard sizes) in any specified rectangular size or shape — All Steel or All Aluminum — for either direct or deflected air flow. Write for Bulletin 43.

DIAMOND ARCHITECTURAL GRILLES

. . . are stamped from Steel, Aluminum, Bronze or any other commercial metal; in a wide variety of artistic designs, in any desired thickness up to one-quarter inch, with correspondingly LARGE unit openings. Widely used, for nearly half a century, in America's finest buildings, they have proved practically indestructible — standing up for years against any probable amount of rough usage. Bulletin 41 illustrates and describes a number of popular designs and applications. Catalog 36 (100 pages) contains actual-size illustrations of ALL Diamond Grille designs, together with complete working data. Write for either or both — no charge or obligation.

DIAMOND MANUFACTURING CO.
Box 41 WYOMING (Wilkes-Barre Area) PENNA.

WE HEAR THAT

Continued

MONSANTO CHEMICAL CO. has licensed *CONTINENTAL MFG. CO.* to manufacture and sell the packaged "Brink" mist eliminator. Continental is the exclusive agent for this product.

DURA-VENT CORP. has purchased a 40,000 sq ft building in Louisville, Ky., for a branch factory and sales office. The address is 1701 W. Burnett Ave.

BABCOCK & WILCOX CO. has been licensed by the *YOUNGSTOWN SHEET & TUBE CO.* to produce and sell welding fittings and flanges of "Yoloy" steel to match Youngstown's piping of the same alloy.

THE SPRINGDAY CO. will have two wings built to its present structure in Springfield, Mo. The firm is a subsidiary of *DAYCO CORP.*

WHEELABRATOR CORP. has purchased the *W. W. CRISWELL CO., INC.*, Riverton, N.J. Criswell produces all types of fabricated bags and blankets for fitering solids from gas or liquid streams.

MARBON CHEMICAL DIV. OF BORG-WARNER CORP. has purchased a plant site at Grangemouth, near Edinburgh, Scotland for construction of a plant to produce "Cycolac" brand polymers and other synthetic resins. Cost of the new plant will be less than $5 million.

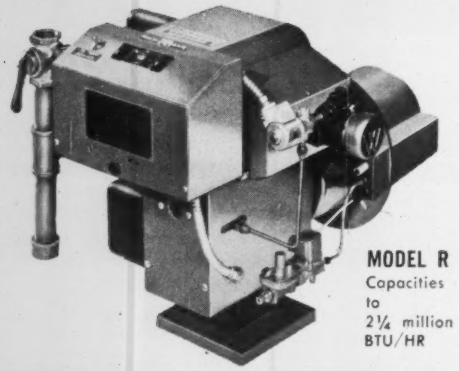
MUELLER CLIMATROL, DIV. OF WORTHINGTON CORP., has completed its Milwaukee, Wis., cooling laboratories expansion program. The new and modified tests rooms can simulate the climate of any area of the world where the firm's equipment is sold. In the middle range of temperatures, control can be held within two tenths of a degree over long periods of time. Total space of the laboratories was increased from 3700 to 6000 sq ft.

E. H. PRICE LTD., of Winnipeg, Manitoba, Canada has been licensed to manufacture and sell the complete line of *TITUS MFG. CORP.'s* air distribution products in Canada.

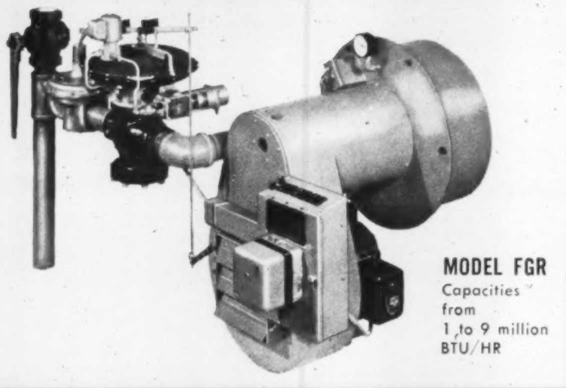
A proposal by management to change the name of American Machine and Metals, Inc., to *AMETEK, INC.* has been made. Action will be taken on the proposal at a special stockholder's meeting November 22.

Gordon & Piatt's
Planned Performance*
forced draft TURBO-RING Burners

DELIVER THE HEAT at
low initial investment —
low operational cost —
low maintenance cost



MODEL R
Capacities
to
2¼ million
BTU/HR



MODEL FGR
Capacities
from
1 to 9 million
BTU/HR

Gas, oil or combination burner

TURBO-RING

Boilers equipped for pressure firing require no stacks . . . merely a vent

G&P

Gordon & Piatt, Inc.
P. O. Box 914
WINFIELD, KANSAS

Gordon & Piatt manufactures a complete line of combustion equipment: Atmospheric gas burners • Power gas burners • Control panels and burners for special applications.

*PLANNED — Factory assembled, pre-wired for "Bolt-on" installation.
*PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

THE

DISTRICT

HEATING

HAND BOOK

THIRD EDITION

A Revised Volume — 529 Pages
15 CHAPTERS — 6"x9¼"

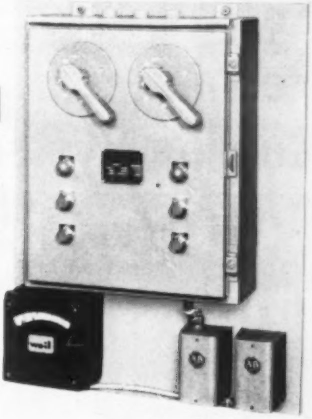
GROWTH AND PRESENT STATUS
ECONOMICS OF DISTRICT HEATING
GENERAL DATA
DISTRICT HEATING PLANTS
WATER CHEMISTRY AND CORROSION
STEAM DISTRIBUTION
METERING
BUILDING HEATING SYSTEMS
CONSUMERS' PROCESS EQUIPMENT
CONSUMERS' ACCESSORY EQUIPMENT
ESTIMATING STEAM REQUIREMENTS
ECONOMICAL USE OF STEAM
RATES
SALES ACTIVITIES
HOT WATER FOR DISTRICT HEATING

Price $7.00
NATIONAL DISTRICT HEATING ASSOCIATION
827 N. EUCLID AVE.,
PITTSBURGH 6, PA.

---

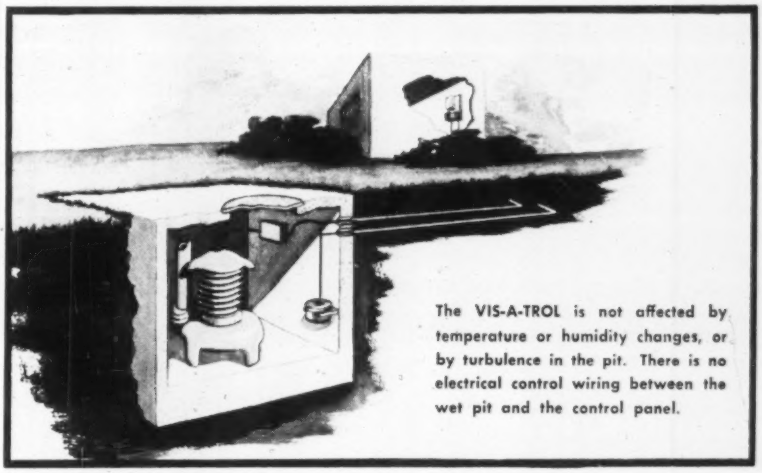
the weil Vis-a-trol

AUTOMATIC
PUMP CONTROL
and
LIQUID LEVEL
INDICATOR



for weil
- Submersible sewage and sump pumps
- Vertical type sewage and sump pumps
- Septic Tank effluent pumps

The weil VIS-A-TROL automatic control system is combined with a depth measuring device which shows the depth of liquid in the pit. The pumping rate can be compared with the in-flow at all times without looking into the wet pit. It is indicated on the instrument and responds instantly to level changes in the sump.



The VIS-A-TROL is not affected by temperature or humidity changes, or by turbulence in the pit. There is no electrical control wiring between the wet pit and the control panel.

The VIS-A-TROL can be installed in outside weather-proof enclosures or installed within a building and may be located as much as 300 feet away from the pumping pit. High and low limits of liquid level control are set at the instrument. It is never necessary to go into the wet pit for control adjustment.

See your weil representative or send for Bulletin AC-100

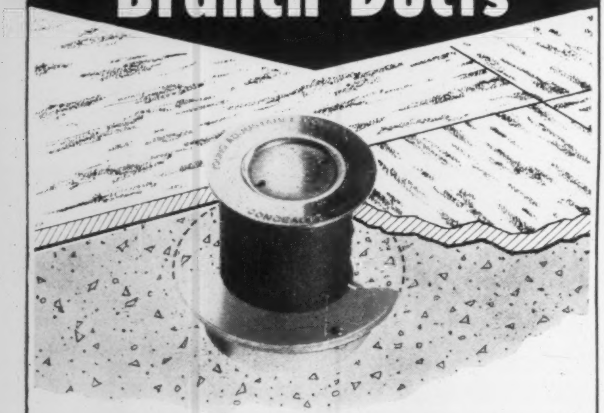
See the weil VIS-A-TROL and other new weil products at Booth 954-958 International Heating & Air-Conditioning Exp. Feb. 13th to 16th.

weil PUMP COMPANY
STAY ONE STEP AHEAD WITH weil

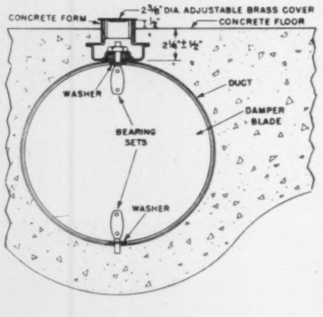
1514 NORTH FREMONT ST. • CHICAGO 22, ILL.

For a **better** balanced Perimeter Heating and Cooling System - *install*

YOUNG Floor Line Adjustable Cover Regulators in Branch Ducts



Adjustable Brass Cover screws down flush with floor after form is removed.



The Young No. 330 Regulator, installed in a branch duct, gives accurate control of the volume of air to the register.

This is the sure way of controlling the required volume of air for individual rooms.

Only 2-3/8" in diameter, the adjustable cover plate fits flush with the floor. Model No. 330 is for installations with up to 2" of concrete above the duct. Other models are available for up to 12" of concrete above the duct.

Write for complete catalog or consult Sweet's Architectural File or the Engineer's Product File.

YR

YOUNG REGULATOR COMPANY
20910 Miles Parkway, Cleveland 28, Ohio

MEETINGS & CONVENTIONS

NOV. 6-10 — Meetings of The American Nuclear Society, The Atomic Industrial Forum, AtomFair, and National Youth Conference on the Atom. Chicago, Ill. Information: John L. Kuranz, ANS general meeting chairman, vice president of Nuclear-Chicago Corp., 333 E. Howard Ave., Des Plaines, Ill.

NOV. 7-10 — National Warm Air Heating and Air Conditioning Association Annual Convention. La Salle Hotel, Chicago, Ill. Information: National Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14, Ohio.

NOV. 12-15 — Air-Conditioning and Refrigeration Institute Annual Meeting. The Homestead, Hot Springs, Va. Information: Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 13-17 — American Public Health Association, 89th Annual Meeting, Air Pollution Session, Cobo Hall, Detroit, Mich. Information: American Public Health Association, 1790 Broadway, New York 19, N.Y.

NOV. 26-30 — The American Society of Mechanical Engineers Winter Annual Meeting. Statler Hilton Hotel, New York, N.Y. Information: L. S. Dennegar, director of public relations, American Society of Mechanical Engineers, 345 E. 47th St., New York 17, N.Y.

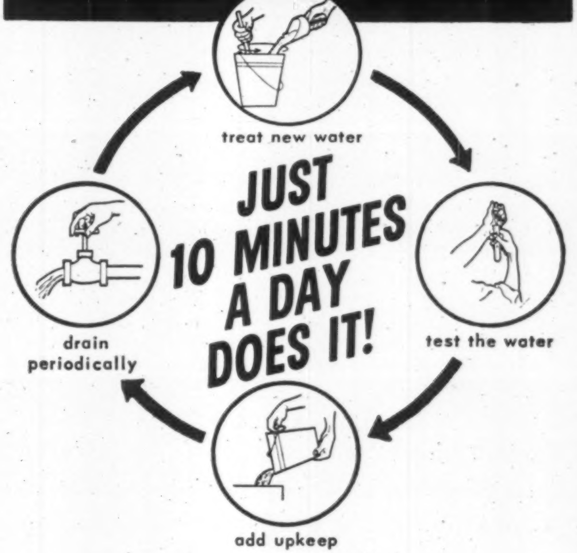
NOV. 28-30 — Building Research Institute's 1961 *Fall Conference.* Mayflower Hotel, Washington, D.C. Information: Milton C. Coon, Jr., executive director, Building Research Institute, 2101 Constitution Ave., Washington 25, D.C.

1962

JAN. 22-25 — Plant Engineering and Maintenance Conference and Show. Convention Hall, Philadelphia, Pa. Information: Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

JAN. 28-31 — American Society of Heating, Refrigerating and Air-Conditioning Engineers Semi-Annual Meeting. Chase-Park Plaza Hotel, St. Louis, Mo. Information: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 345 E. 47th St., New York 17, N.Y.

How to simplify air conditioning system water treatment


treat new water
test the water
add upkeep
drain periodically
JUST 10 MINUTES A DAY DOES IT!

Here's servicing of air conditioner water in the easiest possible way. A routine 10 minute daily check by one man, and Oakite Airefiner No. 52 ... that's all it takes. You end scale, slime, algae and corrosion troubles. You avoid out-of-service time, and maintain cooling efficiency.

The entire operation is simplicity itself. (1) Charge water initially with economical Oakite Airefiner No. 52. (2) A simple once-a-day check of water tells whether any adjustment is needed. (3) Add upkeep, if necessary. (4) Periodically, drain system and replenish with fresh, charged water.

Oakite Airefiner No. 52 leaves no deposit on tubes, is safe, and costs little for initial charge as well as upkeep.

Call in the local Oakite Technical Service Representative to get details and drawings on this money- and trouble-saving procedure. Or write Oakite Products, Inc., 32D Rector Street, New York 6, N. Y.

OAKITE

Export Division
Cable Address: Oakite

specialized
WATER TREATING
materials

Technical Service Representatives in Principal Cities of U. S. and Canada

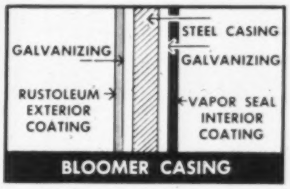
---

BLOOMER

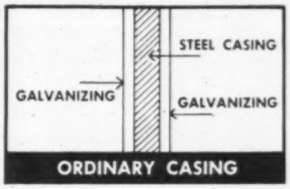
COOLING TOWERS

QUALITY . . . at a competitive PRICE

5 thru 550 Tons in a Single Cell


GALVANIZING
RUSTOLEUM EXTERIOR COATING
STEEL CASING
GALVANIZING
VAPOR SEAL INTERIOR COATING

BLOOMER CASING


STEEL CASING
GALVANIZING
GALVANIZING

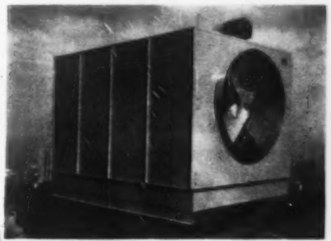
ORDINARY CASING

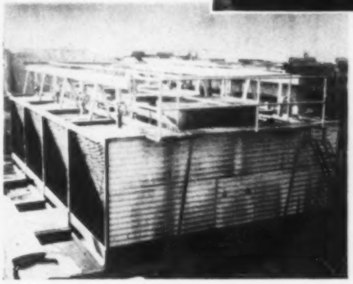
All models thru 200 tons can be shipped factory-assembled for job-site delivery by truck.

All models available knocked-down for easy field erection.

Experienced engineering assistance available.

Single Flow Models
5 thru 80 Tons





Dual Flow
Models
80 thru 550 Tons

FISKE COMPANY
1233 W. 47th St. Chicago 9, Ill.

Send FREE catalog on BLOOMER COOLING TOWERS

Company ____________________

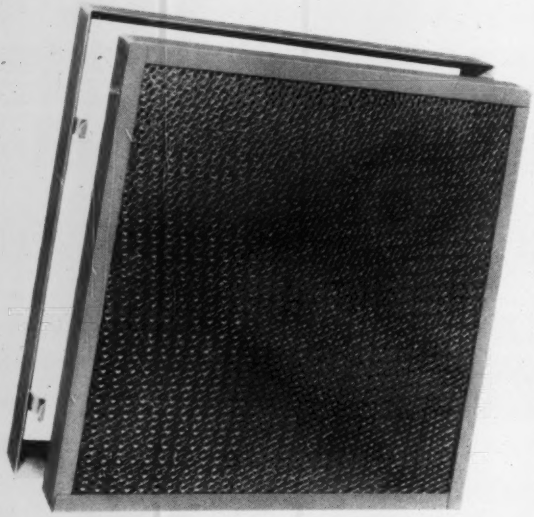
Individual ____________________

Address ____________________

VORTOX

AIR FILTERS

DUST and GREASE



Vortox permanent Filters use genuine coil spring media. Channel formed frames are of heavy gauge steel. Simple and easy to clean.

1. Top efficiency
2. Low restriction
3. High dust capacity
4. High airflow capacity
5. Sturdiness and long life.

Exclusive representation available in some Midwest territories.

AFI MEMBER

Specify VORTOX Air Filters — Engineered and Built for a Lifetime

VORTOX COMPANY

CLAREMONT, CALIFORNIA
(LOS ANGELES AREA)

MEETINGS & CONVENTIONS

Continued

FEB. 12-15 — *Air Conditioning and Refrigeration Industry 12th Exposition.* Great Western Exhibit Center, Los Angeles, Calif. Information: George E. Mills, Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

MARCH 19-21 — *Second National Electric Comfort Heating Exposition, National Electrical Manufacturers Association.* Sherman Hotel, Chicago, Ill. Information: National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N.Y.

MARCH 19-23 — *National Association of Corrosion Engineers Annual Conference and* 1962 *Corrosion Show.* Kansas City Auditorium and Muehlebach Hotel, Kansas City, Mo. Information: National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Tex.

APRIL 9-12 — *24th National Oil Heat and Air Conditioning Exposition.* Chicago, Ill. Information: National Oil Fuel Institute, Inc. 60 E. 42nd St., New York 17, N.Y.

APRIL 30-*MAY* 1-2 — *54th Annual Convention of the Southern Gas Association, combined with the American Gas Association Spring Transmission Conference.* Houston, Tex. Information: Southern Gas Association, Inc., 1524 Life Building, Dallas 2, Tex.

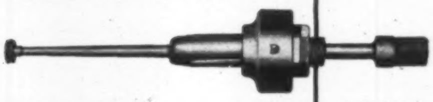
APRIL 25-29 — *Western Space Age Industries and Engineering Exposition.* Cow Palace, San Francisco, Calif. Information: Lykke-Wilkin & Associates, 681 Market St., San Francisco 5, Calif.

MAY 8-11 — *Mechanical Contractors Association of America 73rd Annual Meeting.* Sheraton Hotel, Philadelphia, Pa. Information: Mechanical Contractors Association of America, Inc., 45 Rockefeller Plaza, New York 20, N.Y.

JUNE 4-7 — *Annual Meeting of the Institute of Boiler and Radiator Manufacturers.* Seaview Country Club, Absecon, N.J. Information: Institute of Boiler and Radiator Manufacturers, Room 408, 608 Fifth Ave., New York 20, N.Y.

JUNE 18-20 — *Annual Meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.* Deauville Hotel, Miami Beach, Fla. Information: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 345 E. 47th St., New York 17, N.Y.

TO ROLL TUBES UNIFORMLY TIGHT



#255—for average tube sheets.

work with a WIEDEKE Ideal Tube Expander

#270—for thick or multiple tube sheets.

Made of special analysis tool steels, heat-treated to withstand the most severe service. Precision-built for accuracy. Ball bearing thrust collar minimizes friction, assures uniform, parallel expansion of tubes when used with a Wiedeke Torque Control unit.

E-1

FOR ROLLING TUBES IN HEAT EXCHANGERS, CONDENSERS, COOLERS AND OTHER HEAT TRANSFER UNITS

TUBE SIZES, ¼" through 1½".

Write for Bulletin C

The Gustav
WIEDEKE
Company
DAYTON 1, OHIO
quality cold-rolling tools since 1892

WRAP-ON RUST PROTECTION

for any metal surface Protect any metal surface from rust caused by fumes, oil, water, caustics, greases and most solvents. This tough polyvinylchloride pressure-sensitive tape provides positive protection on any clean, dry surface and conforms to odd or irregular shapes. Easy to apply, "SCOTCHRAP" Brand Pipe Protection Tape requires no special application technique or equipment and is always ready for use. "SCOTCHRAP" is available from your 3M supplier, or write: Electrical Products Division, 3M Company, 900 Bush Ave., St. Paul 6, Minn.

"SCOTCHRAP" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN.

3M MINNESOTA MINING & MANUFACTURING CO.

ELECTRIC HOT WATER HEAT

TO 2,500,000 B.T.U. OUTPUT

SEE OUR CATALOG IN SWEET'S

PRECISION

ELECTRIC HOT WATER HEATING BOILER

COMPLETE UNIT READY FOR INSTALLATION
with circulation hot water system and water chiller for year-round air conditioning.

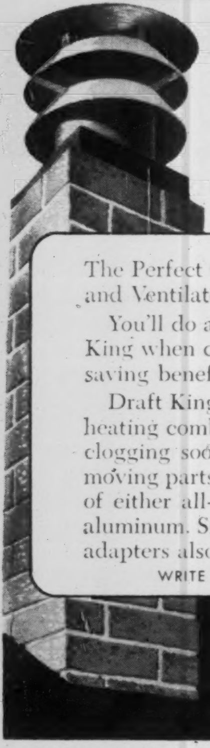
CONVERSION EASILY ACCOMPLISHED
where other type fuels now used. Suited for home, churches, motels, apartments, hotels, hospitals, commercial buildings, swimming pools, snow melting and domestic hot water for large users. Temperature range — 60 to 250 degrees. Equipped with Sequence and Proportional Controls when desired.

- **Every unit tested and inspected 40,948 to 2,500,000 B.T.U. Output.**
- **All Boilers meet the requirements of the ASME Boiler and Pressure Vessel Code. Natl. Board approved.**

No chimney! No odors! No flame! No ducts! No noise!

Write for complete specifications and prices

PRECISION parts corporation
400-HPA NORTH FIRST STREET
NASHVILLE 7, TENNESSEE



Sell Low Cost DRAFT KING Chimney Caps

You make money . . .
Customers save money!
Eliminate downdrafts . . .
side drafts, updrafts!

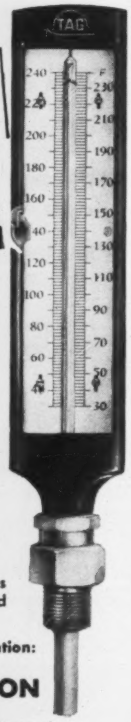
The Perfect Cap for all Chimneys, Flues, and Ventilators.

You'll do a volume business with Draft King when customers learn of its money-saving benefits.

Draft King turns flue gases into perfect heating combustion—eliminates chimney clogging soot and costly fuel waste. No moving parts—nothing to wear out. Made of either all-weather galvanized steel or aluminum. Sizes from 3" to 36". Chimney adapters also available.

WRITE NEAREST PLANT, DEPT. 38.

Manufactured by
A. R. WOOD MFG. CO.
Santa Cruz, Calif. — Luverne, Minn.



For finest quality, absolute accuracy and superior performance, you'll want

INDUSTRIAL
Red-Reading Mercury
Thermometers
by Tagliabue

EXCLUSIVE
Gasket seals glass and frame. Provides dust-tight, moisture-tight, rattle-proof construction.

Over 15 Special features include:
- Die-cast black aluminum case
- Easily read scales
- Magnifying lens for visibility
- Maximum reliability

TAG industrial thermometers are designed for superior performance. Choice 7" or 9" sizes in ranges —40 to 1150°F or equivalent in °C. Guaranteed accurate temperature indication.

Available in straight, back-angle, right or left side and regular or reverse oblique forms.

TAG complete line includes thermometers, hydrometers and humidicators

Write for complete information:
TAGliabue DIVISION
Marshalltown Manufacturing, Inc., Marshalltown, Iowa
A Subsidiary of The Electric AutoLite Company

NEW BOOKS & REPORTS...

Evaporative Cooling of Circulating Waters — Translated from the Russian second edition, this volume gives a systematic account of the basic problems of the theory, design, and application of coolers. Discusses evaporative cooling in ponds, spray tanks, and coolers. First part of book deals with the problems of heat transfer and mass transfer during evaporative cooling, the theory of coolers, and some of the problems of the hydraulics of coolers; the second part describes the design of coolers for circulating water, methods of calculating their cooling capacity, and the main principles of their use. Contains approximately 400 pages, 8½ by 11 in. Written by L. D. Berman, State Power Publishing House, Moscow. Edited by H. Sawistowski, Department of Chemical Engineering, Imperial College. Price, $20.00. — *Pergamon Press, Inc.*, 122 *East 55th St., New York* 22, *N.Y.*

Sheet Metal Layout — An instruction book for the individual who has a basic knowledge of the principles of pattern drafting, and who wants to learn practical shop layout methods. The text covers the standard seams and edges used in the sheet metal shop and the short-cut methods of layout that are standard shop practices. Contains 188 pages, including a three page subject index. Problems are included to test skills taught by book. Price, $5.25. — *McGraw-Hill Book Co.*, 330 *W. 42nd St., New York* 36, *N.Y.*

1960 *Proceedings of the National District Heating Association* — A report in bound-book form of the 51st annual meeting of the association held at Asheville, N.C. Price, $7.50. — *National District Heating Association*, 827 *N. Euclid Ave., Pittsburgh* 6, *Pa.*

1961 *ASHRAE Guide and Data Book* — The 1961 volume of the two-volume new series features 880 pages of reference material on fundamentals and equipment. The second volume, on applications, will appear in 1962. The 1961 volume contains sections on theory, materials, load calculations, system components, air conditioning units and other subjects. Includes a complete index for the 67 chapters, numerous charts, graphs, and tables, and 406 pages of product specifications. Price, $12.50. — *American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., United Engineering Center*, 345 *E. 47th St., New York* 17, *N.Y.*

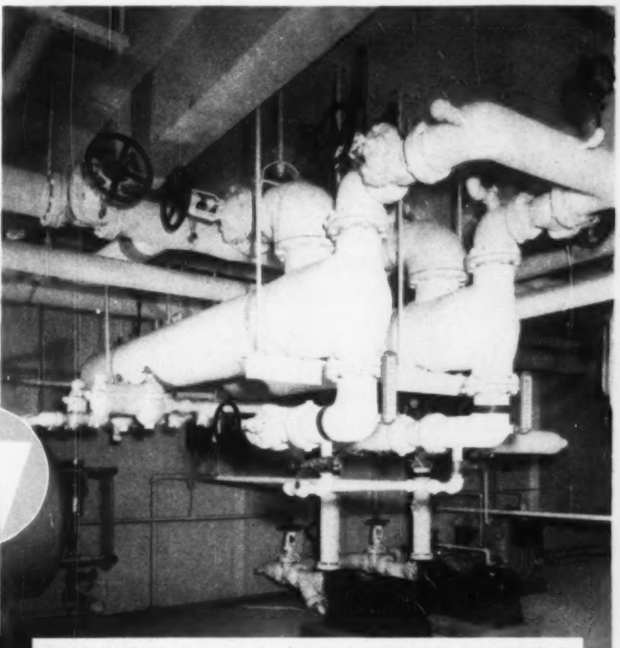
HOT WATER BY WHITLOCK

Rugged and compact, Whitlock Convertors are easy to install and maintain, economical to operate, and have maximum water velocities consistent with minimum pressure drops. For most applications we can supply *standardized* convertors. Our long experience in designing and manufacturing convertors and other water heaters can be very useful when you're selecting and specifying such equipment. We will gladly assist you with any water heating problem . . . Bulletin 62 on request.

The Whitlock Manufacturing Company
44 South Street, West Hartford 10, Conn.

New York • Philadelphia • Boston • Detroit • Chicago • Richmond
Authorized representatives in other principal cities.
In Canada: Darling Brothers, Ltd., Montreal.

Designers and Builders of Bends, Coils, Condensers, Coolers, Heat Exchangers, Heaters, Piping, Pressure Vessels, Receivers, Reboilers.

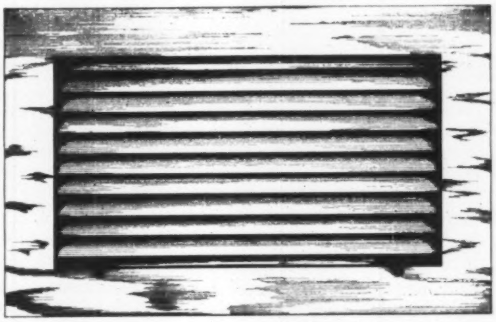


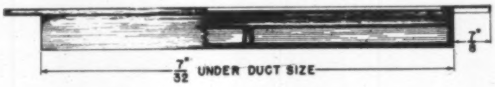
Whitlock Convertors supply hot water needs in the Hartford, Connecticut, Public Library.

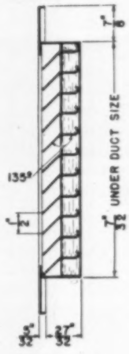
NEW from A-J!

A-J No. 22 Series

Rain and Snow-Proof EXTERIOR STATIONARY LOUVER







Here's ventilation or fresh air intake plus weather protection conveniently combined in a single unit! Completely bird-proof. This stationary exterior louver has closely spaced horizontal bars on 1/2" centers. The louver unit is 13/16" in depth, and manufactured 7/32" under listed size. All-steel construction throughout on the No. 22 style.

The No. A-22 has EXTRUDED ALUMINUM FRAME AND BARS which give an unbeatable combination of strength and durability for long-time exterior application.

Aluminum insect screen available at additional cost.

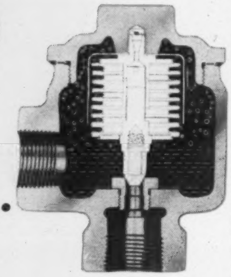
FREE catalog contains complete identification and selection.

Write for your copy.

A-J MANUFACTURING CO.

Dept. H-11 **3601 E. 18th St.**
Kansas City 27, Mo.

ELIMINATE BELLOWS DRIFT



RIGGIO THERMOSTATIC TRAP

Permits no leakage, assures precision positioning and positive shut off. Simple design and rugged construction, provide thousands of trouble free hours of operation.

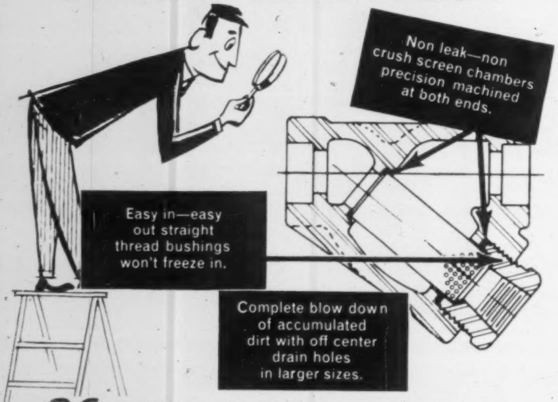
WRITE FOR BULLETIN 1001 OR 90 DAY FREE TRIAL INSTALLATION.

RIGGIO TRAPS & STRAINERS

FRANK D. RIGGIO CO., INC.

STATE HIGHWAY 17 • RUTHERFORD, N. J.

LOOK INTO THE ARMSTRONG STRAINER TO FIND REAL VALUE


Non leak—non crush screen chambers precision machined at both ends.
Easy in—easy out straight thread bushings won't freeze in.
Complete blow down of accumulated dirt with off center drain holes in larger sizes.

P.S. **And they cost no more than any *good* strainer.**

The Armstrong Strainer line is very broad including all popular sizes in cast iron, cast carbon steel (WCB), cast chrome moly steel (WC6), forged steel (ASTM A-182, grade F-22), cast bronze and stainless steel with screwed, socket weld, Silbraz, butt weld or flanged connections. Bulletin 170 gives full details. Ask for a copy.

ARMSTRONG STRAINERS

102-YS Made by the makers of Armstrong Steam Traps

ARMSTRONG MACHINE WORKS

8745 Maple Street • Three Rivers, Michigan

NEW BOOKS & REPORTS

Continued

National Fire Codes, 1961-62, *seven volumes* — Incorporates 48 new fire protection standards adopted by the National Fire Protection Association into an existing 138 other NFPA standards. Volume III, Building Construction and Equipment, contains 36 standards plus an informative discussion of building codes. Price, $7.00 per volume, or $40.00 for the seven volumes. — *National Fire Protection Association,* 60 *Batterymarch St., Boston* 10, *Mass.*

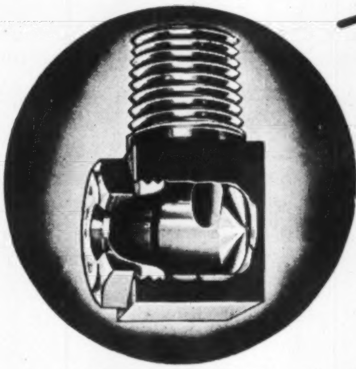
Dimensions and Tolerances for Schedule A Type I and Schedule A Type II Rigid Polyvinyl Chloride Pipe (Lightweight PVC Pipe), Commercial Standard CS237-61 — A recorded voluntary standard of the trade published by the U.S. Department of Commerce in cooperation with the National Bureau of Standards. Price, 5 cents. — *Superintendent of Documents, U.S. Government Printing Office, Washington* 25, *D.C.*

Standard Refrigeration and Air Conditioning Questions and Answers — Provides a quick, practical introduction to the principles and applications of air conditioning and refrigeration. Containing 253 pages plus an index, the book is directed at operating and servicing personnel, as well as trade, vocational schools, and technical institute students. Includes chapters on compressors, condensers, evaporators, controls, fittings, piping, and others. Material is also included on cooling towers, cooling water and brines, safety, and cryogenics. Written by Stephen M. Elonka, Plant Maintenance and Management Editor of Power Magazine; and Quaid W. Minich, industrial refrigeration engineer, York Div. of Borg-Warner Corp. Price, $6.95. — *McGraw-Hill Book Information Service,* 327 *W.* 41 *St., New York* 36, *N.Y.*

SALES ENGINEER

Wanted by well established San Francisco firm to call on mechanical engineers and contractors in the Bay Area. Graduate mechanical engineer under 40, with at least five years of experience in selling heating and ventilating equipment preferred. Excellent base salary and incentive compensation arrangement. If you would like to relocate in sunny California, send a complete resume to:

Norman S. Wright & Company
1015 Folsom Street
San Francisco, California



Monarch

NOZZLES
for
AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.

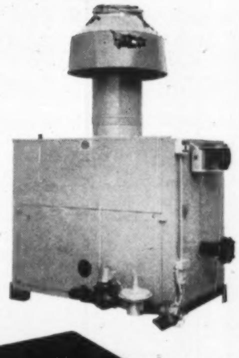
Write for Catalog 1

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.
Canadian Agents: (Except B. C.)
E. S. Gallagher Sales Ltd., Toronto 12, Canada

SPECIFY... INSTALL
PARKER *Hot Water* BOILERS
for the finest in building heating

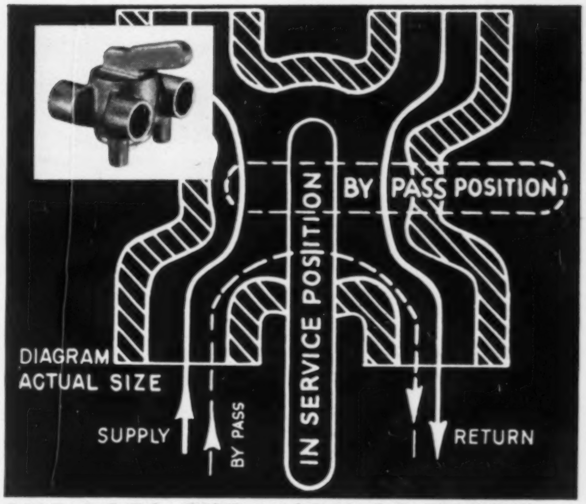
*

Fully packaged steel water tube design, 126M to 5,000M B.T.U. capacities. The ideal boiler for schools, apartments, churches, hotels, institutions, homes, and factories. Proven most successful for hi-temperature water systems. Furnished for gas, oil or combination gas-oil firing. A.G.A. approved. Manufactured in accordance with A.S.M.E. Code. Write for complete description and specifications.



A few territories available for qualified manufacturer's representatives.

SID E.
PARKER BOILER
MFG. CO.
2035 EAST 37TH STREET • LOS ANGELES 58, CALIFORNIA
ADams 3-8263



ONE DOES THE WORK OF THREE...
New Air Conditioning By-Pass Valve

Now—eliminate intricate piping connections for induction and fan-coil air conditioning systems and save space too! Replacing three-unit valve clusters at each coil, this single-control valve does it all—a 1/4 turn opens the by-pass for the flushing operation and shuts off the water supply to the coil and control valve for maintenance. Another 1/4 turn and service is restored. Accepts 1/2 or 5/8" O.D. copper tubing with soldered or flare-type connections. Write for specs and prices on No. 1831 By-Pass valve to...

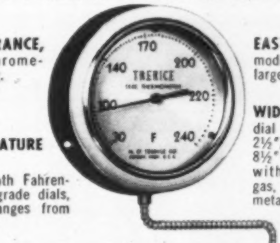
CLAYTON MARK
AND COMPANY
1900 DEMPSTER STREET • EVANSTON, ILLINOIS • U.S.A.
PUMPS WATER WELL SUPPLIES CONDUIT UNIONS TUBING AB-2536

Dependable Accuracy ...
with TRERICE
DIAL THERMOMETERS

If you are after precise, dependable temperature indication, take a close look at these high-quality features of Trerice dial thermometers!

NEAT APPEARANCE, distinctive chrome-plated dial ring.

WIDE TEMPERATURE RANGES, available in both Fahrenheit and Centigrade dials, temperature ranges from -100° to 1000° F.



EASY TO READ, modern aluminum dial, large figures.

WIDE VARIETY, dial available in 2", 2½", 3½", 4½", 6", 8½" and 12" diameters with mercury, vapor, gas, solid liquid or bi-metal actuation.

All the many other standard and special option features of Trerice dial thermometers are contained in Bulletin No. 500-M. Write for your copy.

Send Bulletin 500-M.
Name ....
Address ....
City .... Zone ...... State ....

H.O. TRERICE CO. 1420-B W. Lafayette Blvd.
Detroit 16, Michigan

new technology in
WOVEN WIRE CLOTH
for gas fired
INFRA-RED BURNERS

Manufacturers are using woven wire cloth as the most practical burning surface for gas fired Infra-Red Heaters. Woven wire cloth has proved its efficiency and economy for pre-mix and gravity type burners. It is rugged and reliable—withstands the rigors of expansion and vibration—endures broad ranges of temperature cycling.

The majority of Infra-Red users of woven wire cloth rely on Cleveland Wire Cloth for their requirements. We have taken combustion engineers' specifications and designed them into efficient woven wire Infra-Red burners. Through research, we are developing new and better applications for woven wire cloth burning surfaces. Let us apply this new technology to your problems.

***Free*— Bulletin 160 containing the full range of square mesh and square opening space cloth.**

CLEVELAND WIRE CLOTH

**THE CLEVELAND WIRE CLOTH
AND MANUFACTURING COMPANY**
3585 E. 78th St. • Cleveland 5, Ohio • Phone DI 1-1832

NEW BOOKS & REPORTS

Continued

Net Load Recommendations, 1960-61 — Released by the Mechanical Contractors Association of America, this 146 page book has the net load recommendations for heating boilers, baseboard, convectors, and finned-tube radiation. Gives the testing and rating codes for boiler-burner units. All ratings have been approved by the MCA National Boiler Output Committee through special certification of test data provided by the manufacturer or on the acceptance of the codes set up by the American Gas Association, the Institute of Boilers and Radiator Manufacturers, or the Steel Boiler Institute. A 26 page supplement to the book includes additional ratings plus the net load ratings of the Package Firetube Boiler Section of the American Boiler Manufacturers Association. Price, $5.00; supplement, $2.00. — *Mechanical Contractors Association of America, Suite* 570, 45 *Rockefeller Plaza, New York* 20, *N.Y.*

Call Us For Air Cleaning Help!

AFI MEMBER AIR FILTER INSTITUTE

Every building presents a special air cleaning problem. For the best solution — no matter what type of building — get expert help from members of the Air Filter Institute listed below. These companies are dedicated to giving you the assistance you need.

**Air Devices, Inc.
185 Madison Avenue
New York 16, New York**

**Air Filter Corporation
4554 W. Woolworth Avenue
Milwaukee 18, Wisconsin**

**Air-Maze Corporation
25000 Miles Road
Cleveland 28, Ohio**

**American Air Filter Co., Inc.
215 Central Avenue
Louisville 8, Kentucky**

**Barnebey-Cheney Company
Cassady at Eighth
Columbus 19, Ohio**

**Continental Air Filters, Inc.
2520 Helm Street
Louisville 9, Kentucky**

**Dollinger Corporation
11 Centre Park
Rochester 3, New York**

**Drico Industrial Corporation
100 Eighth Street
Passaic, New Jersey**

**Fram Aire Company
Division of Fram Corporation
135 Zone Street
Henderson, N.C.**

**Minneapolis-Honeywell Regulator Co.
Minneapolis 8, Minnesota**

**Owens-Corning Fiberglas Corporation
1833 National Bank Building
Toledo 3, Ohio**

**Research Products Corporation
1015 E. Washington Avenue
Madison 10, Wisconsin**

**Technical Filter Co.
2719 South Poplar Avenue
Chicago 8, Illinois**

**Trion, Inc.
1000 Island Avenue
McKees Rocks, Pennsylvania**

**Union Carbide Development Co.
270 Park Ave.
New York 17, N.Y.**

**Vortox Company
121 S. Alexander Avenue
Claremont, California**

**Westinghouse Electric Corporation
Sturtevant Division
Hyde Park, Boston 36, Massachusetts**

Air Filter Institute, Box 85, Station E, Louisville, Kentucky

Statement required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, July 2, 1946 and June 11, 1960 (74 Stat. 208) showing the ownership, management, and circulation of HEATING, PIPING & AIR CONDITIONING published monthly at Chicago, Illinois for October 1, 1961.

1. The names and addresses of the publisher, editor and business managers are:

Publisher, Chas. E. Price, 1120 Greenleaf Ave., Wilmette, Illinois.

Editor, Robert W. Roose, 911 S. Catherine Ave., LaGrange, Illinois.

Business Manager, C. M. Burnam, Jr., 8933 S. Leavitt St., Chicago, Illinois.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Keeney Publishing Company, 6 N. Michigan Ave., Chicago 2, Illinois. Stockholders: R. A. Jack, 3565 Glen Allen Dr., Cleveland Heights 21, Ohio; Chas. E. Price, 1120 Greenleaf Ave., Wilmette, Illinois; W. J. Osborn, 1029 Old Post Rd., Fairfield, Connecticut.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: 17,771

Chas. E. Price, President

Sworn to and subscribed before me this 11th day of September, 1961

(SEAL)

Lydia Thomas
(My commission expires November 21, 1963)

For leakproof, pressure-tight connections..

TiteSeal
Gasket & Joint
SEALING COMPOUNDS

Heat-proof, vibration-proof. Will not shrink, crack or crumble. Prevents formation of rust and corrosion—makes disassembly easy.

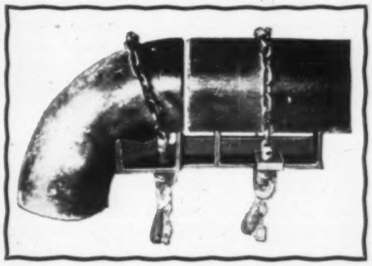
7 Basic Blends

Solder Seal

At your wholesaler!

2194

RADIATOR SPECIALTY CO., Charlotte, N. C.



. . . enough JEWEL clamps cut erection costs

PIPE WELDING CLAMPS

Jewel Pipe Clamps are lightweight — rigidly constructed — resist strain, heat and abuse.

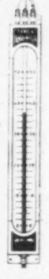
FOR WELDING
PIPE • FLANGES •
ELBOWS • ANGLES
—also PIPE MARKERS

Jewel Clamps align pipe perfectly, and hold it there until it is welded. Size, 1/2" to 8". Write for details.

JEWEL
MANUFACTURING CO.
1841 University Ave.
St. Paul 4, Minnesota.

CLASSIFIED ADVERTISING

Rates for classified advertising are 20 cents for each word including heading and address. One inch $8.00. Count nine words for keyed address. Minimum $3.00 for each insertion. Cash must accompany order. Closing date 10th of month preceding issue.



TANKoMETER
FOR MEASURING TANK CONTENTS
ANY DISTANCE AWAY

ANY LIQUID

TANK MAY BE BURIED, ELEVATED, OPEN, CLOSED, VENTED OR UNDER PRESSURE OR VACUUM

Send for Bulletins

Also gauges for:
Barometric Pressure (Mercury Column)
Absolute Pressure (Mercury Column)
Pressure and Vacuum
Differential Pressure
Inclined Manometers for draft. pressure or differential pressure.

UEHLING INSTRUMENT CO. 19 VESPER ST., PATERSON, N. J.

SITUATIONS OPEN

LIVE IN FLORIDA

A small Florida manufacturer needs an engineer with experience in manufacturing and application of fans to participate in general management. Ideal opportunity for exceptional young man in early 30's. Please send personal history and salary requirements to Key 1541A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

ASSISTANT SALES MANAGER between 27 and 35 years of age, with mechanical engineering degree and with good knowledge of commercial and industrial air conditioning equipment. Write, stating qualifications and salary desired, to Thermal Engineering Corp., manufacturers, P. O. Box 13464, Houston 19, Texas.

Registered HAV Engineer with at least 5 years ex-perience needed for permanent employment by Middle West consulting engineers. Excellent potential with growing firm. Please send resume, salary requirements and availability to Key 1543A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

SALES ENGINEER — Challenging opportunity for growth with leading manufacturer of heat exchangers, pumps, and hot water heating equipment for a man experienced in selling specification equipment to wholesalers, contractors, and engineers. Engineering or technical degree or equivalent experience. Willing to relocate and travel. Send resume to Key 1530A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

FIELD ENGINEER — Permanent position for graduate mechanical engineer thoroughly experienced in all branches of industrial building construction. Moving expenses paid. Send complete resume to Key 1545A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

AGENTS WANTED

MANUFACTURER'S AGENTS

An established manufacturer with 25 years experience, producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans. The products include axial flow and tubeaxial fans, both direct and belt driven and power roof ventilators. Please reply key 1361-A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

WANTED — Agents handling HVAC equipment and calling on architects, engineers, contractors, etc., to handle a complete line of registers, grilles and ceiling diffusers. Liberal commission basis and exclusive territories are available. Write lines carried, territory and types of accounts covered. Reply Key 1519A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

REPRESENTATIVES WANTED — leading manufacturer of nameplates, valve tags, pressure-sensitive pipe markers for identifying mechanical equipment seeks manufacturers' agents servicing mechanical contractors. Wide acceptance by Consulting Engineers and the Trade. Seton Nameplate Co., Inc., New Haven 15, Conn.

REPRESENTATIVES WANTED — for top quality line of registers, grilles, diffusers, etc. Established manufacturer has a number of exclusive territories open. Unusually fine commission basis for manufacturers agents calling on architects, engineers, contractors etc. Please reply Key 1520A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

SITUATION WANTED

ME — 15 years' project experience in dust and fume control, HVAC, industrial hygiene, drying and refrigeration desires responsible position. Address Key 1542A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

NAMEPLATES

IDENTIFICATION NAME PLATES for controls and panels—precision engraved on bakelite or black anodized alum — any titles — quick service by mail on small or large jobs — send for sample and prices. ATLANTIC ENGRAVERS, Coldbrook Road, Wilmington, Vermont.

LINES WANTED

MANUFACTURERS' REPRESENTATIVES covering Northern California desire an additional line. Now calling on architects, engineers and mechanical contractors. Please reply Key 1544A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Contractor items wanted. Manufacturers' representative enjoying 35th successful year has room for one more good line. Northern New Jersey, Metro New York territory, representing top notch manufacturers in the heating, ventilating and plumbing field. Address Key 1537A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

AGENTS WANTED

WANTED — Agents calling on HVAC trade to sell the Mechanical Estimator's Guide. Only volume of its kind. Sells on sight. Liberal commission. Dept. T.G., 224 N.E. 59th St., Miami, Florida.

INDEX TO ADVERTISERS

Firms represented in this issue are identified by the page on which their advertising appears. Advertising in other issues is marked with an asterisk.

A

A & A Register Co., The 186
ACF Industries Inc.—W-K-M Div. *
Acme Industries Inc. 113
Adsco Div., Yuba Consolidated Industries, Inc. *
Aerofin Corp. 203
Aerovent Fan Co., Inc. *
Air & Refrigeration Corp. *
Air Cond. & Refrig. Institute 231
Air Devices, Inc. 19
Air Filter Corp. *
Air Filter Institute 266
Air-Maze Div. Rockwell-Standard Corp. *
Air Moving & Conditioning Association 204
Airtherm Mfg. Co. *
A-J Mfg. Co. 263
Aladdin Heating Corp. 249
Alco Valve Co. 25
Allen-Bradley Co. 86
Allied Chemical Corp., General Chemical Div. 27
Allied Metal Hose Co. 194
Alnor Instrument Co., Div. of Illinois Testing Laboratories, Inc. 248
American Air Filter Co., Air Filter Div. 207
American Air Filter Co., Engineered Air Systems Div. *
American Chain & Cable Co., Inc.—RP&C Valve Div. 97
American Gas Association 68, 69, 76, 77
American Machine and Metals, Inc., DeBothezat Fans Div. *
American Metal Mfg. Co. 240
American Sisalkraft Corp. *
Ammerman Co., Inc. 230
Amprobe Div., Amprobe Instrument Corporation *
Anaconda American Brass Co. 182
Anaconda Metal Hose Div., Anaconda American Brass Co. 96
Anderson Co., V. D. Div. of International Basic. Economy Corp. 188
Anemostat Corp. of America 91
Arkla Air Conditioning Corp. 68, 69
Arkos Mfg. Co. *
Armstrong Cork Co. 31
Armstrong Machine Works 103, 264
Arrow-Hart & Hegeman Electric Co. *
Arrow Louver & Damper Corp. *
Atmos-Pak, Inc. *
Auburn Machine Works, Inc. *
Aurora Pump Co. *

B

Babbitt Steam Specialty Co. 247
Babcock & Wilcox Co., Tubular Products Div. 3
Badger Mfg. Co. *
Barber-Colman Co. 180, 181
Barco Mfg. Co. 192
Barry Blower Co. 18
Bartlett-Snow-Pacific, Inc. 196
Bastian-Morley Co., Inc. 200
Bell & Gossett Co. 15 83
Bethlehem Steel Company 173
Binks Mfg. Co. *
Bird-Archer Co. 224
Bohn Aluminum & Brass Corp. *
Boiler Engrg. & Supply Co., Inc. 226
Bonney Forge & Tool Works 198
Breidert Co. The G. C. *
Bros, Inc., Power Division 208
Bryant Mfg. Co., The *
Buensod Stacey, Inc. *
Buffalo Forge Co. 32
Burgess-Manning Co. 227
Burke and Company *
Butt Mfg. Co. *
Byers Co., A. M. *

C

Campbell Heating Co. 107
Capitol Mfg. Co. 78
Carlon Products Corp. 210
Carnes Corp. *
Carrier Air Conditioning Co. 66, 67, 195
Central Station Steam Co. 234
Century Electric Co. 72, 73
Chatleff Controls, Inc. *
Chicago Blower Corp. *
Chicago Pump Co. 95
Chrysler Corp. Airtemp Div. 215
Clarage Fan Co. Inside Back Cover
Cleveland Wire Cloth Co. 266
Colonial Plastics Mfg. Co. *
Combination Pump Valve Co. *
Combustion Engineering, Inc. *
Connor Engineering Corp. *
Continental Air Filters, Inc. 30
Continental Equipment Co. Div. of Fisher Governor Company *
Cook Co., The Loren *
Crane Co., Industrial Products Group 209
Crane Co., Pacific Steel Boiler Div. *

D

Davidson Fan Co. 244
DeBothezat Fans Div., American Machine and Metals, Inc. *
DeZurik Corporation *
Diamond Mfg. Co. 255
Dodge Mfg. Co. *
Dole Refrigerating Co. *
Dunham-Bush, Inc. 34, 225
Durabla Mfg. Co. *
Duriron Co., Inc., The 185
Dwyer Mfg. Co., F. W. 236

E

Eagan Co., Inc., Walter H. 234
Edwards Engineering Corp. *
Electro Dynamic, a Div. of General Dynamics *
Electronics Corp. of America, Combustion Control div. 74
Enterprise Burner Div., div. of General Metals Corp. 214
Erie Mfg. Co. 206
Everlasting Valve Co. *
Ewing Mfg. Co. *
Exitaire Co. 236

F

Fairbanks Co., The 216
Fairbanks, Morse & Co. *
Fanjet Div. of Mullermist Irrigation Co. *
Farris Engineering Corp., Mil Div. 230
Field Control Div. Conco Engrg. Works, Inc. *
Fiske Co. 259
Flexible Tubing Corp. 235
Flexonics, div. of Calumet & Hecla, Inc. 23
Flintkote Co., The Van Packer Div. 84
Fluor Products Co. *
Foster Co., Benjamin *
Frederick Iron & Steel, Inc. *
"Freon" Products div., duPont de Nemours & Co., Inc., E. I. 233
Fuller Co., Lehigh Fan & Blower Div. 218
Fulton Sylphon Div., Robertshaw-Fulton Cont. Con. 202

G

Garlock, Inc. *
General Controls Co. *
Goodall Rubber Co. 228
Gordon & Piatt, Inc. 256
Governair Corp. 80
Greenlee Tool Co. *
Grinnell Co., Inc. 28
Gustin-Bacon Mfg. Co. 174, 175

H

Halstead & Mitchell 24
H & M Pipe Beveling Machine Co. *
Hansson Inc. Elof 111
Hastings Air Control 197
Havens Cooling Towers, Div. of Havens Structural Steel Co. 85
Heat-Timer Corp. *
Henry Valve Co. *
Hoffman Specialty Mfg. Corp. 10
Hussey & Co., C. G. *
Hydrotherm, Inc. 232
Hygrodynamics, Inc. *

I

Ilg Electric Ventilating Co. 62, 63
Illinois Testing Laboratories, Inc. 248
Imperial Damper Co. 13
Independent Register Co., The *
Industrial Acousitcs Co., The *
Industrial Combustion, Inc. *
Ingersoll-Rand Co. *
Insul-Fil Co. *
Iron Fireman Mfg. Co. *

J

Janitrol Heating & Air Conditioning A Div. of Midland-Ross Corp. *
Jenkins Bros., Inc. Inside Front Cover
Jenn-Air Co., Inc. 90
Jewel Mfg. Co., Inc. 267
Johns-Manville 54, 55, 178, 179
Johnson Service Co. Outside Back Cover

K

Keckley Co., O. C. *
Keflex Mfg. div. of U. S. Flexible Metallic Tubing Co. 75
Kennedy Valve Mfg. Co. 222
Koppers Company Inc. *

L

Lennox Industries, Inc. 190, 191
Leslie Co. *
Liquidometer Corp. *
Longyear Co., E. J. *
Lustrik, Inc. *

M

Magnetrol, Inc. 254
Mark and Co., Clayton 265
Marley Co., The *
Marlo Coil Co. *
Marshalltown Mfg. Inc., Tagliabue Div. 262
Marsh Instrument Co., Div. of Colorado Oil and Gas Corp. 199
McDonnell & Miller, Inc. 79
McQuay, Inc. 4
Mercer Rubber Co. *
Mercoid Corp., The *
Microtron Corp. *
Midcontinent Metal Products Co. *
Midland-Ross Corp. 184
Miller Electric Mfg. Co., Inc. *
Miller Valve Co., Inc. 241
Mine Safety Appliances Co. *
Minneapolis-Honeywell Regulator Co. 56, 57
Minnesota Mining and Mfg. Co. 239, 261
Miracle Adhesives Corp. *
Monarch Mfg. Works, Inc. 265
Moore, Inc., Goodloe E. 243
Moore & Co., Samuel, DeKoron Products Div. 21
Mueller Climatrol Div. of Worthington Corp. *
Murray Mfg. Co., D. J. *

N

Nash Eng. Co., The 114
National Airoil Burner Co., Inc. *
National Supply Co., The Tubular Products Div. 51
National Tube Div., United States Steel Corp. 189
Nesbitt Inc., John J. 14, 205
New York Blower Co., The *
Niagara Blower Co., The 238
Nordstrom Valve Div., Rockwell Mfg. Co. 35, 36, 37, 38, 39, 40, 41, 42
Norman Products Co. *

O

Oakite Products, Inc. 259
Octagon Ventilator Mfg. Co. *
Ohio Brass Co. 93
Ohio Injector Co. 201
Owens Corning Fiberglas Corp., Industrial & Commercial Div. *

P

Palmer Thermometers, Inc. 243
Parker Boiler Mfg. Co., Sid E. 265
Patterson-Kelley Co., Inc., The 98
Peck Company, Cecil C. *
Peerless Electric Div., H. K. Porter Co., Inc. *
Peerless Pump Div., Food Machinery and Chemical Corp. *
Penn Controls Inc. *
Penn Ventilator Co. 109
Pennsylvania Flexible Metallic Tubing Co. *
Perfection Div. of Hupp Corp. 76, 77
Permacel, Inc. *
Petro *
Phelps Dodge Copper Products Corp. 100
Philadelphia Thermometer Co. *
Phillips Cooling Tower Co. 64, 65
Pittsburgh Corning Corp. 176, 177
Pittsburgh Plate Glass Co., Fiber Glass Div. *
Potts Co., Horace T. Speedline Fittings Div. 22
Powell Valves 99
Powers Regulator Co. 6, 7
Precision Parts Corp. 261
Precision Thermometer and Instrument Co. *
Pyle-National Co., The, Multi-Vent Div. 33

Q

Quickdraft Company 253

R

Radiator Specialty Co. 267
Ramset Fastening System, Winchester Western Div., Olin *
Rawlplug Co., Inc., The *
Ray Burner Co. *
Raybestos-Manhattan Inc., Manhattan Rubber Div. 219
Reed Mfg. Co. *
Reliance Electric & Eng. Co. *
Rempe Company 246
Republic Steel Corp. *
Research Products Corp. 187
Revere Copper & Brass, Inc. 58, 59
Reznor Mfg. Co. 223
Richmond Engineering Co., Inc. 9
Ric-wiL, Inc. 92
Ridge Tool Co., The *
Riggio Co., Inc., Frank R. 264
Roberts Co., C. A. 250
Roberts-Gordon Appliance Corp. *
Robvon Backing Ring Co. *
Rockwell Co., W. S. *
RP&C Valve Div.-American Chain & Cable Co., Inc. 97
Ruberoid Co., The *

S

St. Clair Rubber Co. 247
Sarco Co., Inc. 70, 71, 242
Sarcotherm Controls, Inc. 70, 71, 242
Schemenauer Mfg. Co. *
Sealmaster Bearings Div. of Stephens-Adamson Mfg. Co. *
Shaw-Perkins Mfg. Co. 252
Silvercote Products, Inc. *
Skidmore Corp. 217
Skil Corp. 87
Sonoco Products Co. 237
Southern Plastics Company 244
Speedline Fittings Div. Horace T. Potts Company 22
Spence Engineering Co. *
Sporlan Valve Co. 81
Sterling, Inc. 240
Stockham Valves and Fittings *
Superior Combustion Industries, Inc. *
Surface Combustion Div., Midland-Ross Corp. 184

T

Taco Heaters, Inc. 20
Taylor Forge & Pipe Works 88, 89
Taylor Instrument Cos. *
Thermal Engineering Corp. *
Titus Mfg. Co. *
Tjernlund Mfg. Co. *
Trane Co., The 52, 53
Trerice Co., H. O. 265
Tuttle & Bailey Div. of Allied Thermal Corp. *
12th National Exposition, Air Conditioning, Heating & Refrigeration Industry, The 229

U

Uehling Instrument Co. 267
Union Carbide Chemicals Co., Div. of Union Carbide Corp. *
Union Carbide Development Co., div. of Union Carbide Corp. *
United Cork Companies *
Universal Metal Hose Co. *
U. S. Air Conditioning Corp. 251
U. S. Flexible Metalic Tubing Co. 75
United States Register Co. 211
U. S. Rubber Company *
United States Steel Corp. 189

V

Van Dorn Iron Works Co., The, Infra-Red Div. 221
Van Packer Co., Div. The Flintkote Co. 84
Vapor Corp. *
Vilter Mfg. Co., The *
Virginia Chemicals and Smelting Co., Refrigeration Div. 60, 61
Vortox Co. 260

W

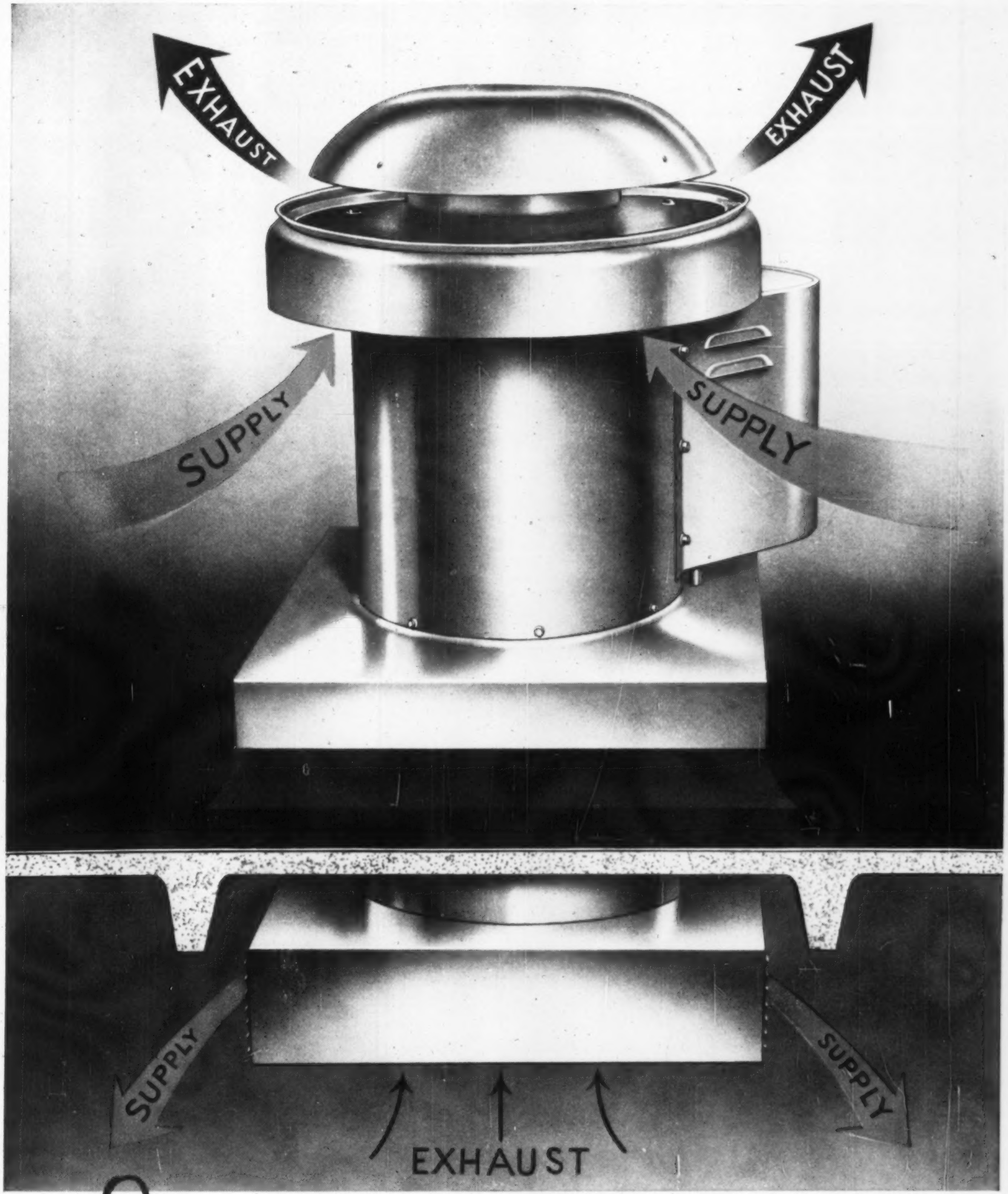
Wagner Electric Corp. 8, 94
Walker Mfg. & Sales Corp. *
Walworth Company 16, 17
Waterloo Register Co. *
Webster & Co., Inc. Warren *
Webster Engineering, a div. of Midland-Ross Corp. *
Weil-McLain Co. 26
Weil Pump Co. 257
Weinman Pump Mfg. Co., The 212
Weirton Steel Co. *
Weksler Instruments Corp. 220
Western Engineering & Mfg. Co. 245
Wheatland Tube Co. *
Wheeler C. H./Griscom-Russell *
Wheeling Steel Co. 193
Whitlock Mfg. Co., The 263
Wiedeke Co., The Gustav 261
Williams Gauge Co. 246
Wilson Engineering Co. *
Wing Mfg. Co., L. J. Div. of Aero-Flow Dynamics, Inc. *
Wiremold Co., The 238
Witco Chemical Co. *
W-K-M Div. of ACF Industries, Inc. *
Wood Mfg. Co., A. R. 262
Wood's Sons Co., T. B. 82
Wright & Co., Norman S. 264

Y

Yarnall-Waring Co. 29
Young Radiator Co. *
Young Regulator Co. 258
Youngstown Sheet and Tube Co. 104, 105
York Corp., Subsidiary of Borg-Warner Corp. *
Yuba Aimco Div. Yuba Consolidated Industries, Inc. *

Z

Zallea Brothers *

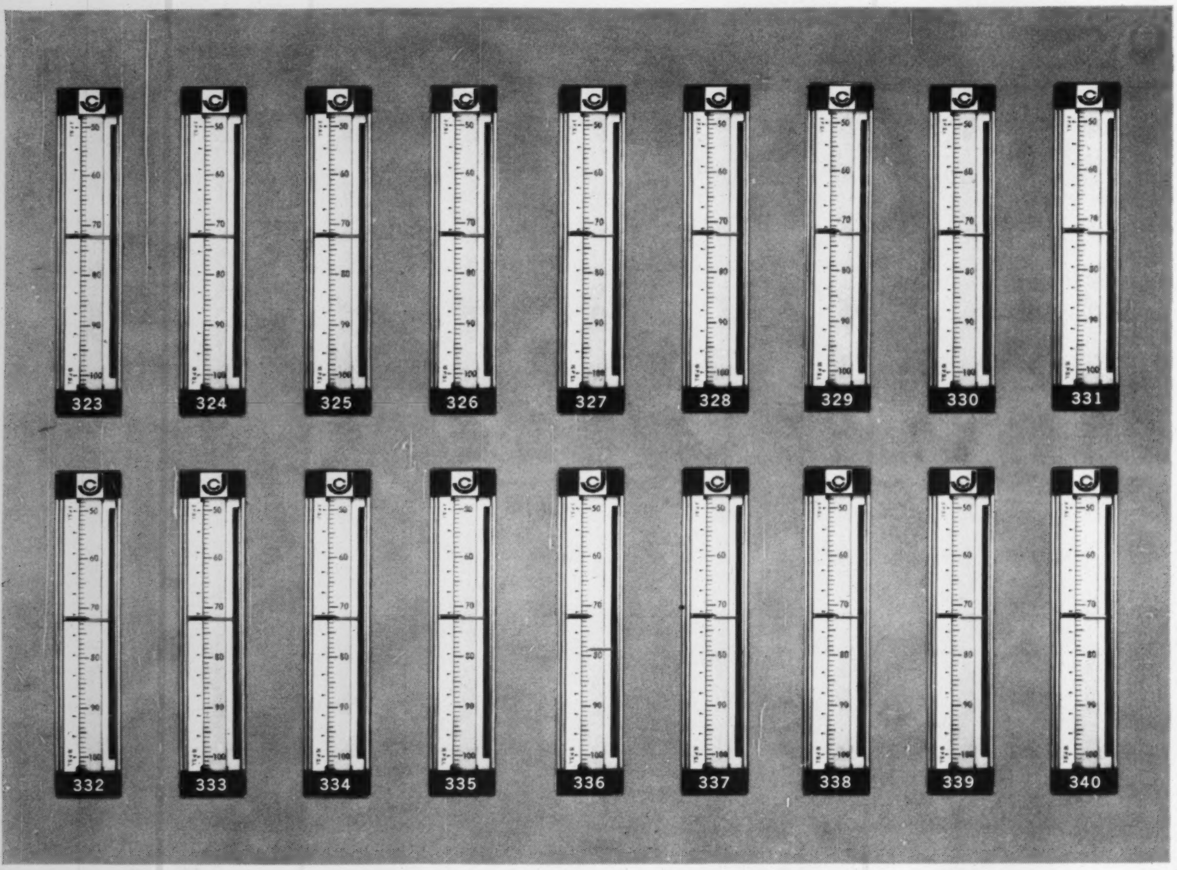


One impeller does it

You get both air supply and exhaust simultaneously with the new Clarage TWINALATOR*. Unique, superior dual function air handling for all types of buildings. Definite money-saving advantages: Requires only one opening, one motor, one drive, one starter. No make-up air unit necessary. Applications unlimited — well adapted to closed or semi-closed systems. Can be provided with heating coils and filters. Write today for Bulletin 552. CLARAGE FAN COMPANY, Kalamazoo, Michigan. Clarage sales engineering offices are located in all principal cities.

*Patented Trademark

TRY THIS 2-SECOND SCANNING TEST



see how fast you find the "trouble" spot

You spotted it instantly, of course . . . and thereby demonstrated to yourself how modern pneumatic controls save important operational time and dollars in operating air conditioning and heating systems.

Similarly, from a Johnson Pneumatic Control Center, the engineer can scan the panel to check key temperatures, humidities, pressures, and other data and *instantly* detect deviations from normal settings.

The continuous visual display of operating data is an outstanding advantage of pneumatic control. It permits accurate, remote observation of an entire system. It saves time and manpower and adds greatly to the economy and efficiency of operating any air conditioning or heating system.

On your next building or air conditioning project, ask your Johnson representative about this and the many other advantages of pneumatic temperature control systems and control centers. There is no obligation. Johnson Service Company, Milwaukee 1, Wisconsin. 110 Direct Branch Offices.

JOHNSON CONTROL
PNEUMATIC SYSTEMS
DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885